

# Mobile Communication Technology and National Identity in Sub-Saharan Africa

## **Donghyun Danny Choi (Corresponding Author)**

Assistant Professor of Political Science  
University of Pittsburgh  
4600 Wesley W. Posvar Hall,  
Pittsburgh, PA, 15260, USA  
Phone: +1 (412) 648-7250  
Email: dannychoi@pitt.edu

## **Benjamin Laughlin**

Assistant Professor of Political Science  
New York University Abu Dhabi  
PO Box 129188, Saadiyat Island,  
Abu Dhabi, United Arab Emirates  
Phone: +1 (202) 556-4236  
Email: benjamin.laughlin@nyu.edu

## **Anna Schultz**

Independent Researcher  
10175 Spring Valley Drive,  
Mount Horeb, WI 53572  
Phone: +1 (734) 657-1570  
Email: schultz.anna@gmail.com

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# Mobile Communication Technology and National Identity in Sub-Saharan Africa

## Abstract

We examine how the expansion of mobile internet infrastructure affects national identity in sub-Saharan Africa. In diverse societies where elections are contested along ethno-communal lines, we argue that access to mobile internet undermines national identity because it facilitates voter exposure to the polarizing tendencies of internet-based social media and communication platforms. Applying both difference-in-differences and boundary designs on mobile coverage maps and geocoded survey data of more than 100,000 African citizens, we show that access to mobile internet reduces identification with the nation by up to 5–7 percentage points. To establish support for our electoral mechanism, we exploit as-if random variation in the timing of individuals' survey interviews to presidential elections, during which we argue divisive and polarizing forces are at their peak. Our analysis shows that electoral proximity intensifies the negative effect of mobile internet. These findings highlight how technological innovations can inhibit the process of state-building in diverse societies.

# 1 Introduction

Innovations in communication technology have played a central role to the formation of national identities in the modern state. The widespread adoption of printing technology, for example, encouraged the use of a common written language, enabling communications between geographically dispersed groups that previously did not have the means necessary to interact with each other (Anderson, 1983). The process of engaging in common discourse and “imagining” themselves as a part of a broader community larger than their own ethno-communal groups ultimately allowed citizens to develop a collective sense of belonging to their nation as a whole. The technology also provided political elites with a platform to promote an agenda establishing a common national history which would contribute to the formation of a national identity (Deutsch, 1966; Weber, 1976).<sup>1</sup>

Of the many advances in communications infrastructure since the invention of the printing press, mobile communications technology—mobile internet service in particular—has been arguably the most transformative. Unlike the dial-up and broadband internet, whose benefits have largely been confined to the developed world, the reach of cell phones has extended to a majority of populations in the developing world, including much of South and Southeast Asia, Latin America, and sub-Saharan Africa and has allowed individuals to gain consistent access to the internet for the first time in their lives. The geographic extent of coverage is so broad that mobile internet is available in places where other types of infrastructural development have failed to penetrate. The parallels between the printing press and mobile internet—lowering the cost of communication, and connecting millions of previously unconnected people—may lead us to anticipate that the rapid expansion of cell phone networks over the past two decades would exert similar integrative pressures on users to develop attachments to their collective national communities.<sup>2</sup>

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<sup>1</sup>While we focus on communication technology, other scholars focus on broader aspects of modernization as a whole. An earlier literature on state-building suggests that the process of modernization facilitates the construction of a national identity (Anderson, 1983; Gellner, 2008; Weber, 1976). Other theorists, focusing on the developing world, call into question this perspective and suggest modernization accomplishes the opposite: a hardening of ethnic divisions (Melson and Wolpe, 1970; Bates, 1974). A recent empirical investigation by Robinson (2014) has tested these theoretical arguments, and has found evidence consistent with the observation that modernization increases an individual's propensity to identify with the state.

<sup>2</sup>A recent empirical investigation has found that when nationalist rhetoric promulgated by elites are delivered through conventional broadcast media such as television or radio, audiences tend to become more nationalistic (Bleck

Despite these clear parallels, there are strong reasons to be more skeptical of the integrative potential of mobile internet expansion, especially in the context of the developing world where such expansion is perhaps likely to be the *most* transformative. First, the structural, institutional, and sociodemographic characteristics of the Global South today differ significantly from those of 18-19th century Western Europe, upon which much of the earlier literature linking technological innovations to the formation of a national identity have primarily focused (Weber, 1976; Gellner, 2008). Second, while its far-reaching nature might be similar to previous communications revolutions, distinctive features of mobile internet service, as a medium through which broad segments of the population gain low-cost access to internet-based platforms and infrastructure—may create conditions that foment polarization rather than integration (Lelkes, Sood and Iyengar, 2017; Settle, 2018).

These divergent theoretical expectations provide the motivation for our paper; in investigating the relationship between the expansion of mobile technology and national identity, we develop and test a theory that focuses on voter access to the internet and online social media platforms, the nature of electoral politics, and the incentives of politicians to reinforce existing parochial divisions within society. We argue that in contexts where communal (for example ethnic, racial, or religious) boundaries demarcate the axes of political competition, politicians are electorally motivated to promote a divisive agenda along these pre-existing societal cleavages. Mobile phone coverage, and mobile *internet* services in particular, provide increased citizen access to internet and internet-based media platforms, which are often captured by politicians to promote polarizing platforms that improve their electoral prospects. These tendencies are exacerbated with the campaign cycle: the degree of polarization on these internet-based media platforms intensifies as elections approach.

In providing support for this argument, we focus our attention to the case of sub-Saharan Africa. As made clear by Figure 1, Africa has witnessed an explosive expansion in mobile internet service over the past decade, with the number of people who have access to mobile internet increasing from virtually zero in 2007 to 825 million in 2019. Mobile internet service now penetrates more than and Michelitch, 2017).

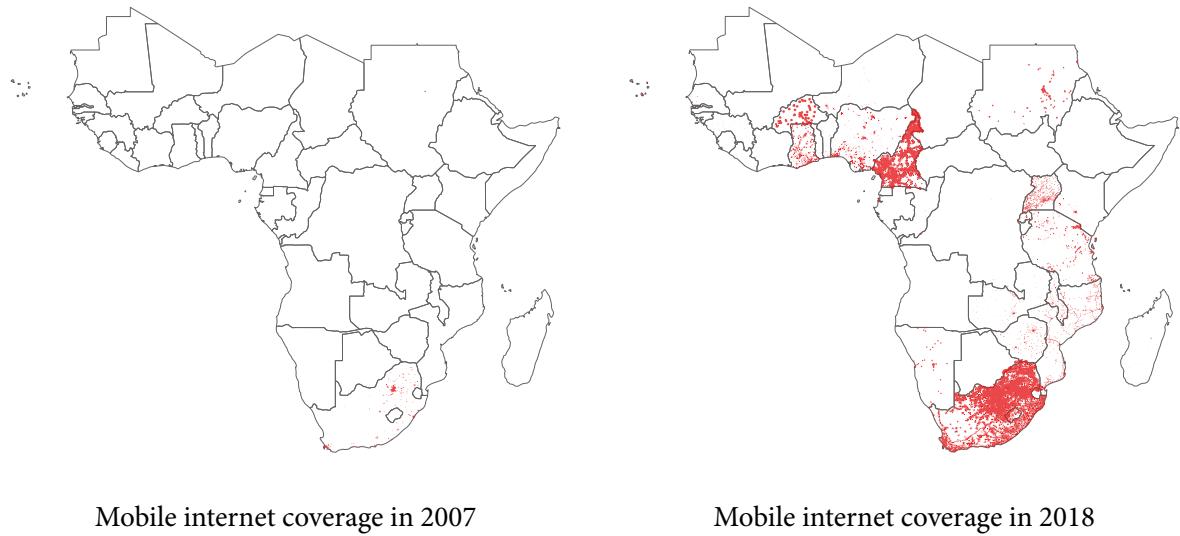


Figure 1: Maps illustrate the expansion of mobile internet coverage in sub-Saharan Africa between 2007 and 2018. Maps were created using coverage data provided by Collins Bartholomew and the GSM Association.

79 percent of Africa's population.<sup>3</sup> We combine detailed yearly geospatial data of mobile internet coverage and geocoded survey responses from rounds 3–7 of the Afrobarometer surveys, which measure the extent to which an individual privileges their identification with their nation relative to the communal (ethnic, regional, religious) group to which they belong.

In order to identify the effect of mobile internet coverage on the extent to which citizens identify with the nation state, we implement a difference-in-differences design, which exploits temporal variation in the extent of mobile internet coverage across different waves of the Afrobarometer. We also supplement our main empirical approach with a boundary analysis that compares the level of national identification of survey respondents that fall just on either side of the cell coverage boundary.

Analyses using our difference-in-differences design, as well as our supplemental boundary design, provide broad support for our argument. Using the difference-in-differences design, we find that expanded access to mobile internet (or 3G) service across sub-Saharan Africa leads to a sta-

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<sup>3</sup>For more information on the growth of mobile internet access see “New ITU data reveal growing Internet uptake but a widening digital gender divide,” retrieved on November 26, 2020, at <https://www.itu.int/en/mediacentre/Pages/2019-PR19.aspx>. Figure A2 shows that the growth in mobile internet access has been accompanied by concordant increase in mobile internet subscriptions across Sub-Saharan Africa.

tistically significant decrease in an individual's propensity to identify with the nation over their ethnocommunal group by up to 5~7 percentage points. These effects persist even after accounting for demographic differences between individuals living with and without mobile coverage, as well as for heterogeneity in local infrastructural and economic development in covered versus non-covered areas. Our boundary design also demonstrates a negative effect of mobile internet on national identification, even with a significantly reduced sample. By contrast, we do not detect any effect of the expansion of basic mobile phone (2G) service, which does not provide access to the internet-based platforms through which we argue election-driven polarization occurs.

To empirically test our posited theoretical mechanisms, we exploit as-if random variation in the timing of individual survey respondent's interview to the date of the presidential elections, during which polarizing forces on internet-based media platforms are at their peak. If *mobile internet* indeed functions as a key mechanism through which individuals are exposed to the polarizing influence of elections, we should expect people with mobile internet access to become less attached to the nation as high-salience elections draw nearer. We find that this is indeed the case; proximity to elections significantly amplifies the negative effect of mobile internet coverage.

The findings presented in this paper offer insights regarding the sociopolitical consequences of one of the most significant developments in communications infrastructure in the world. While earlier work has tied the expansion of mobile phone service to group-level outcomes such as political violence ([Pierskalla and Hollenbach, 2013](#)) and protest and repression ([Christensen and Garfias, 2018](#)), we show that it also has profound social-psychological implications for individuals in how they relate to their nation state. Given that the salience and persistence of ethnocommunal identities and the relative weakness of national identities have been identified as root causes of conflict and state fragility in Africa, our findings have important implications for the study of state-building in developing contexts.

Our research also contributes to the broad community of scholars working on deepening our understanding of identity—social, ethnic, national—as an outcome to be explained. Much of the work in this area has focused on how long-term processes or macrosocial structures such as colo-

nial legacies and modernization affect ethnic or national identities (Ekeh, 1975; Bates, 1974; Posner, 2004; Robinson, 2014). Yet a recent group of scholars have examined the effect of meso-level factors that operate in the intermediate to short run on social identities (Peisakhin and Rozenas, 2018; Bleck and Michelitch, 2017). We join these scholars in arguing that a relatively recent development such as the expansion of mobile internet service can have consequences for how an individual defines their relationship to the state. We believe this supports the increasing consensus that ethno-national identities are a social construct that are fluid and susceptible to change (Chandra, 2012; Eifert, Miguel and Posner, 2010; Michelitch, 2015).

In what follows, we first introduce our theoretical argument regarding the impact of mobile internet coverage on national identity. We then explain the data sources we use for the analysis, followed by describing the empirical strategy we employ to identify the effect of cellphone coverage. We then discuss the results of the analysis, and conclude by discussing the implications of our findings, as well as directions for future research.

## 2 Mobile communication technology and national identity

### 2.1 Beyond the economy: The societal impact of mobile technology

Despite the explosive growth of mobile communications technology around much of the world, our understanding of its societal impact still remains relatively limited. Unsurprisingly, the past decade has witnessed a notable accumulation of theoretical and empirical research that examine the economic consequences of mobile coverage; from its impact on buyer and seller behavior and welfare (Aker, 2008; Aker and Mbiti, 2010), commodity prices in different markets (Muto and Yamano, 2009), firm earnings and profits (Samuel et al., 2005), as well as the effect of spin-off technologies such as mobile money on poverty (Suri and Jack, 2016).

Yet studies that extend their inquiry beyond these traditional economic domains are difficult to come by. A nascent body work in political science has started probing these effects with respect to repertoires of collective action, based on the intuition that mobile technology can reduce

the informational and coordination costs that deter individuals or groups from mobilizing in the pursuit of common goals ([Pierskalla and Hollenbach, 2013](#)). In support of this thesis, these studies have found that mobile coverage expansion across Sub-Saharan Africa is robustly associated with increased incidence of social protest and political conflict and violence.

While these studies constitute important first steps to our understanding of the impact of mobile technologies, a long line of theoretical literature on previous innovations in communications gives us reason to expect that the effect of mobile phones is likely to be far deeper, perhaps even affecting psychological and cognitive processes that structure how individuals perceive and situate themselves within the broader society or community to which they belong.

Seminal work by scholars such as [Deutsch \(1966\)](#) and [Weber \(1976\)](#), for example, envisioned that advances in communication technology would play a critical role in the process of nation-building. They argue that these technologies contribute to the creation of a public sphere ([Habermas, 1989](#)), a “constellation of communicative spaces in society that permit the circulation of information, ideas, debates, ideally in an unfettered manner, and also the formation of political will ([Dahlgren, 2005](#), 148).” A common foundation upon which cross-cutting interactions and dialogue between heterogeneous groups that otherwise would not have had any exposure or contact with each other is likely to reduce bias against outgroups ([Broockman and Kalla, 2016](#); [Choi, Poertner and Sambanis, 2019](#)), and help citizens coalesce around a more collective sense of belonging to a superordinate entity that transcends parochial divisions ([Wenzel, Mummendey and Waldzus, 2008](#); [Mutz, 2002](#)).

Yet a contrasting perspective, gaining prominence amongst a much more recent group of analysts and observers, casts doubt on this optimistic outlook regarding the bridging potential of technology. Focused heavily on assessing the nature and impact of new media, this school of thought has been more skeptical about the ability of these technologies to create a public sphere that the above scholars had envisioned ([Yardi and Boyd, 2010](#); [Conover et al., 2011](#); [Settle, 2018](#)).

Rather than serving as a forum for the cross-cutting exchange of ideas and collective democratic dialogue, scholars have provided evidence that these venues have effectively become “echo cham-

bers” in which individuals sort into clusters that share similar political opinions and attitudes , and thus seldom have the opportunity to interact with others that do not share in their beliefs (Sunstein, 2001; Colleoni, Rozza and Arvidsson, 2014). Furthermore, the extensive degree of self-sorting into homogeneous groups can exacerbate the well-documented tendency of individuals to selectively seek out information that reinforces, rather than moderates, their prior beliefs (Bimber and Davis, 2003; McPherson, Smith-Lovin and Cook, 2001, 23). Such exposure to like-minded individuals is associated with the adoption of more extremist positions that can lead to further polarization and radicalization (Mutz and Martin, 2001).

We build on these two literatures that posit a connection (albeit in different directions) between communication technology and social identities to develop an argument on the impact of mobile service expansion on national identities in diverse societies such as those found in Sub-Saharan Africa. In so doing, we emphasize the interplay between the salience of pre-existing ethnocultural identities, the nature of electoral competition and the elite incentives structured by it, and the capture of mobile technologies by these elites.

## 2.2 Elections, mobile technology, and national identity in diverse societies

In hypothesizing the relationship between mobile communication technology and national identities in diverse societies, we begin from an important observation in the existing literature that spans the subfields of comparative and American politics; that electoral competition has the potential to reinforce pre-existing parochial divisions in society (Ferree, 2010; Dunning, 2011; Michelitch, 2015).<sup>4</sup> Scholars have characterized elections as a “zero-sum contest between groups, in which gains by any one group is considered as a loss for all others (Arriola, 2012, 11). Due to the widespread perception among voters that losing in elections means being excluded from power and the ability to access the distributive capabilities of the states, politicians are incentivized to mobilize and appeal

<sup>4</sup>In our view, this argument is not *necessarily* related to whether a polity is considered to have *democratic* electoral competition. Even in autocracies or competitive authoritarian regimes, opposition parties are often allowed to contest in local or even national elections (Levitsky and Way, 2010). We anticipate that these dynamics—whereby elections intensify existing divisions within society—will manifest so long as parties associated with different identity-based social groups contest is not completely prohibited from participating in the electoral process.

to parochial interests “in ways that sharpen communal antagonisms (Horowitz, 2016; Bates, 1974).” Others have also argued that elections constitute key junctures in which the relative standing of groups are subject to inherent uncertainty, and anxieties or concerns over the loss of status or recognition are intensified (Horowitz, 1985; Sambanis and Shayo, 2013; McClendon, 2018). Since voters are motivated to stem these uncertainties and anxieties by expressively voting “for their group” (Brennan and Hamlin, 1998), politicians stand to benefit by utilizing campaign strategies that “evoke pride, grievances, or contempt” that are associated with parochial belongings (Gadjanova, 2017).

A few scholars have recently empirically tested the observable implications of these ideas using compelling research designs. For example, Eifert, Miguel and Posner (2010) has leveraged the as-if random variation in the proximity to elections at the individual survey respondent level to demonstrate that citizens across Sub-Saharan Africa are significantly more likely to select their ethnicity as the social grouping to which they feel a sense of attachment, in comparison to class/occupation, gender, or religion. Using a field experiment implemented at different points in the electoral cycle in Ghana, Michelitch (2015) shows that market-place discrimination along ethnopolitical lines are significantly more likely in time periods that are proximate to elections. Similarly Arriola et al. (N.d.) shows that campaigns rallies intended to induce cross-ethnic voting among supporters of an opposing ethno-partisan group two weeks prior to the presidential elections in Kenya are likely to backfire, and induce voters to coalesce around their own groups candidate.

It is under these conditions—wherein elections tend to ossify voter attachment to their ethno-communal identities, and politicians are incentivized to mobilize around these identities—that we argue that the expansion of mobile technology is likely to intensify polarization and undermine national identity in diverse societies. We specifically identify mobile *internet* technology as the main vehicle through which this process happens.

From the perspective of politicians, the mobile internet provides them with a highly effective channel through which they can promote the parochial agenda described in the preceding paragraph (Rajput, 2014; Ncube, 2019).<sup>5</sup> Traditionally, campaigns in the developing world are neither

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<sup>5</sup>For some descriptive accounts as to how politicians are leveraging mobile internet platforms for the purpose of electoral campaigning, “WhatsApp: The Widespread Use of WhatsApp in Political Campaign-

professionalized nor concentrated around conventional mass media, and politicians must rely on conventional modes of campaigning such as handouts, door-to-door canvassing or mass rallies to reach out to voters, which can become time and resource intensive (Brierley and Kramon, 2020).

Social media platforms such as Facebook and Twitter, as well as messaging services such as Whatsapp and Telegram can drastically improve the efficacy of conventional modes of campaigning. First, these platforms facilitate a broader dissemination of information regarding conventional campaign events, expanding the potential set of voters who are likely to attend. They can also allow the messages delivered in person by politicians at these campaign events to be spread far beyond the networks of voters who were physically present at the rally. But the opportunities afforded to politicians do not stop there; in addition to increasing the efficacy of conventional modes campaigning (Nyabola, 2018), social media and messaging platforms allow politicians to make direct contact with a significantly larger number of voters who would otherwise not be inclined to attend these in-person campaign events (Rajput, 2014; Adebanjo, 2019). Furthermore, with social media politicians are significantly less constrained in terms of the *frequency* with which they can reach out to their supporters, as well as the extent of individual or group-level targeting or adjustment of their outreach to ensure that their message is having the intended impact (Nyabola, 2018).

In addition to enhancing both the efficacy and reach of campaign activities, social media platforms provide fertile ground for the spread of disinformation (Lazer et al., 2018). Given that one of the defining developments of modern political campaigns is the increasing *negativity* of rhetoric, it is perhaps unsurprising that politicians will be tempted to use these new platforms to launch attacks against their foes (Iyengar, Sood and Lelkes, 2012). In an environment where editorial forbearance on unchecked/unvalidated facts and stories—one of the corrective pressures often observed in conventional print and broadcast news media—no longer constrains coverage, politicians and their agents potentially gain the unfettered availability to taint the image of their opponents with misinformation and falsehoods by taking to social media. Furthermore, they can watch as their

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ing in the Global South”, retrieved on February 24, 2020, at <https://ourdataourselves.tacticaltech.org/posts/whatsapp/>. See also, The Economist, “How WhatsApp is used and misused in Africa”, retrieved on February 24, 2020 at <https://www.economist.com/middle-east-and-africa/2019/07/18/how-whatsapp-is-used-and-misused-in-africa>.

machinations percolate through the online sphere as their supporters disseminate and reproduce these negative attacks through their own social networks ([Lupu, Bustamante and Zechmeister, 2020](#), 163-165). Where political friends and foes are primarily defined along ascriptive group boundaries, these dynamics are likely to intensify animus towards both candidates and voters belonging to out-groups.

Access to the mobile internet places voters directly under the influence of the polarizing social media environment cultivated by these politicians. The frequent interaction with polarizing information and content is likely to set in motion the process for voters to reify their loyalties to their ethnic groups and disassociate themselves from a “national community” that their reified group loyalties undermines. But it is not just through the influence of the divisive rhetoric that politicians advance on internet-based platforms that leads voters down the path of polarization ([Mpofu, 2013](#), [2019](#)). Voters themselves can engage in a class of well-documented behaviors that perpetuate or even intensify these processes of polarization; such as confining their interactions online to individuals or groups who share their parochial alignments ([Sunstein, 2018](#); [Settle, 2018](#)) or selectively consuming and sharing information that reinforces rather than contradicts their own beliefs ([Adida et al., 2017](#); [Arriola et al., N.d.](#)).<sup>6</sup>

The preceding discussions have highlighted the importance of mobile internet technology in shaping identities in diverse societies. We generate the following testable, empirical prediction regarding the impact of mobile internet service expansion.

**Hypothesis 1 (Mobile internet coverage):** *The expansion of mobile communication technology, and mobile internet service in particular, is likely to increase citizen identification with parochial ethno-communal identities, and therefore decrease national identification.*

We have also emphasized how the electioneering period are likely to be moments where the

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<sup>6</sup>This is not to say that there is no disagreement as to whether the media environment, as facilitated by the proliferation of online media, actually reinforces polarization. For examples of this emerging body of work, see [Guess \(Forthcoming\)](#) and [Peterson, Goel and Iyengar \(2019\)](#).

polarizing forces are at their peak. We thus anticipate that as election campaigns intensify along the election cycle—i.e. as the day of the election approaches—voters with access to mobile internet service will be even more inclined to identify with their ethnocommunal groups, and less with their national community, in comparison to those without access.

**Hypothesis 2 (Mobile internet × election proximity):** *The polarizing influence of mobile internet is likely to intensify as elections draw near, during which polarizing forces are their peak.*

We have focused on the effect of mobile internet because the existing literature renders clear predictions about how access to mobile internet will structure the behavior of politicians as well as voters, and the process through which polarization is likely to occur. We note, however, that our posited mechanisms for mobile internet fails to extend to the case of *basic mobile phone service*—which provides users with “talk and text” capabilities—because it does not grant politicians or voters with access to the internet and the social media platforms that are based on internet technology nor internet-based messaging apps such as Whatsapp or Telegram.

### 3 Context: Mobile Technology and Identity Politics in Africa

As briefly described earlier, we study the implications of mobile internet access on elections and identity politics in a period of an unprecedented expansion of mobile communications infrastructure across the African continent. Figure A2 in the SI Appendix shows that within a span of just over a decade, the continent went from virtually no mobile broadband penetration to close to 80% of the population (825 million) covered by 3G mobile service—the minimum threshold service for consistent access to internet via mobile phones—and more than 30% with access to a rapidly expanding higher-speed infrastructure such as 4G and 5G service.

The expansion of mobile internet service has been accompanied by a surge in active social media users (numbering more than 210 million), an overwhelming majority (93%) of which report

primarily accessing social media platforms such as Facebook or Twitter via their mobile phones.<sup>7</sup> More important than the sheer number of new social media users is the manner in which social media platforms are used by those with access: whereas prevailing accounts of mobile internet access and social media in Africa as well as the developing world emphasizes their economic implications, there is significant reason to believe that mobile internet and social media are fast becoming fora for citizens to acquire and share information regarding politics and government.

Figure 2 presents data from 2017 Pew Global Attitudes Surveys across six Sub-Saharan African countries with some of the highest rates of mobile internet penetration on the continent—Ghana, Kenya, Nigeria, Senegal, South Africa, and Tanzania—regarding patterns of internet and social media usage across a representative sample of adult citizens (Pew Research Center, 2018). The top panel of Figure 2 plots the proportion of individuals who report that they use the internet for either economic (make or receive payment / look for or apply for a job / buy a product) or political purposes (get news and information about politics / get information about government services). In step with the much-discussed emergence of online mobile money solutions (e.g. M-PESA in Kenya), slightly less than 50% of respondents across the six African countries report using the internet to make or receive payments. But more surprisingly, an even higher proportion of internet users<sup>8</sup> report that they use the internet to obtain information about politics and government services. These figures vastly outnumber the proportion of individuals who use the internet to apply for jobs or purchase a product. Use of the internet as a means to acquire political information seems to find parallels in responses to the question probing the reasons internet users post on social media platforms. As seen in the bottom panel of Figure 2, while social media users more commonly report posting to share views about sports, close to 40% of all users report using social media platforms to share their political views.<sup>9</sup>

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<sup>7</sup>See *Baobab News*, “Digital 2019 : Global and African Social Media use Accelerates”, retrieved at <https://africa.baobab.news/2019/07/03/digital-2019-global-and-african-social-media-use-accelerates/> on November 24, 2020

<sup>8</sup>Internet users include those who have a broadband subscription or own a smartphone.

<sup>9</sup>The Pew Global Surveys, conducted in 2017 also tracked the proportion of individuals who report that they have posted their own thoughts on political or social issues online. Respondents in African countries such as South Africa (11%), Kenya (14%), and Nigeria (17%) are significantly more likely than citizens in countries in Europe, such as Greece (6%), Hungary (5%), Poland (7%) to report that they have done so in the past year.

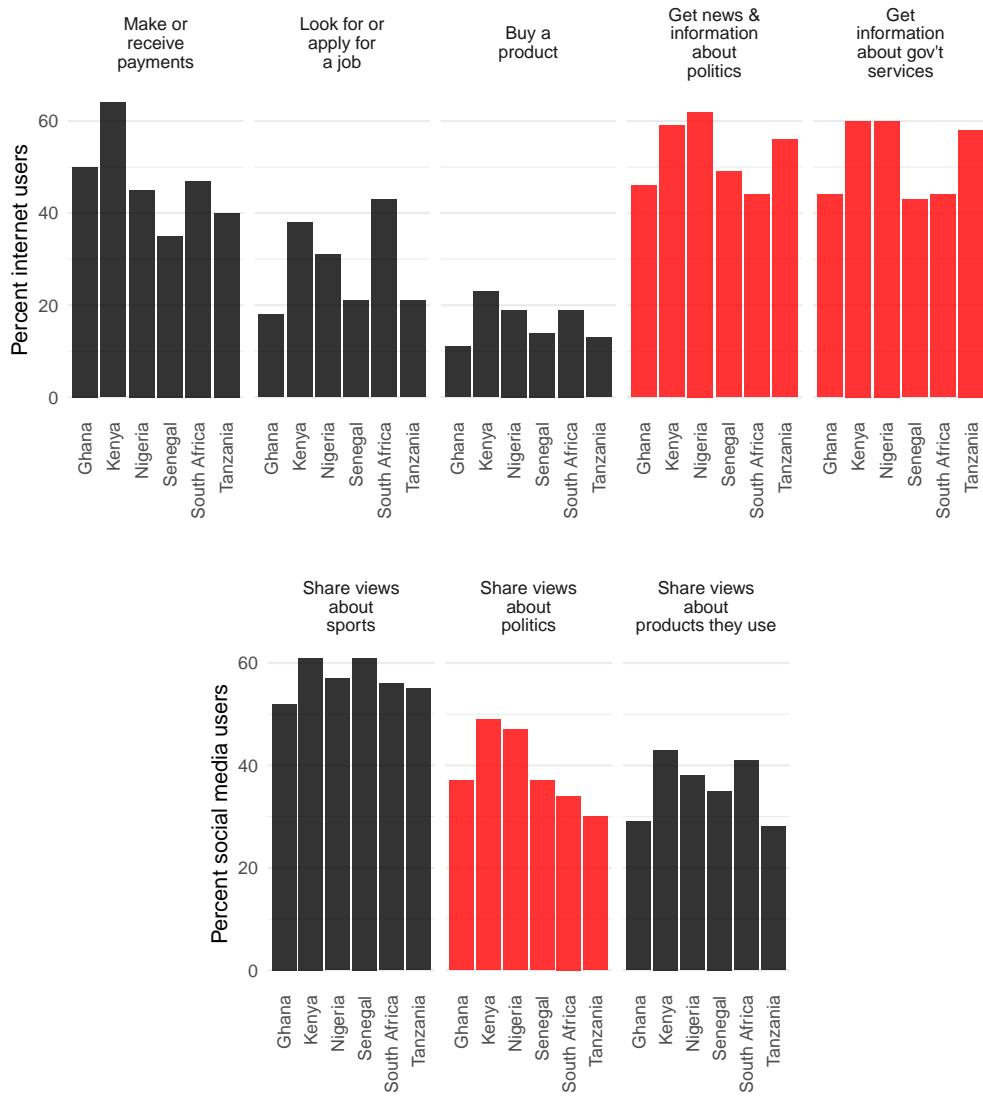


Figure 2: Africans use the internet to get news about politics and to post to social media their political views. Data source: Pew Global Attitudes Survey, Spring 2017.

The emergence of mobile internet and social media as a center of political activity is likely related to why political parties and politicians are increasingly establishing a social media presence and increasingly taking their election campaigns to these platforms. Yet as politicians turn their eyes towards social media as a venue for electioneering, concerns over the potentially divisive and polarizing potential of such activities have already begun to accumulate. The 2017 presidential elections in Kenya provide a clear example of how online social media platforms can foment extreme polarization and cross-ethnic tensions and hostility. As the competition between incumbent pres-

ident Uhuru Kenyatta and opposition coalition leader Raila Odinga escalated in the run-up to the elections, social media platforms were inundated with negative posts—often by politicians communicating in their ethnic group’s vernacular—designed to generate anxieties about the consequences of electoral defeat in the hands of ethnic others.<sup>1011</sup>

While these posts are too numerous to describe individually, one particular incident regarding a viral video posted on social media encapsulates the extent of these polarizing influences succinctly. This video, which was not formally claimed by any of the political parties or politicians running in the election, was uploaded to Youtube less than a month prior to the election with the ostensible objective of casting the consequences of an Odinga presidency in a negative light. In addition to sensational footage of Kenya burning in the wake of post electoral violence and conflict, the video made explicit references to how Odinga’s victory would likely result in the displacement of “whole tribes and communities.”<sup>12</sup>

Similar concerns over the use of social media as a forum for instigating interethnic tensions were also raised during the 2019 Presidential elections in Nigeria. As the informal system of rotational presidency between the predominantly Muslim / Hausa-Fulani dominated north and Christian / Yoruba-Igbo dominated south collapsed in 2015, political candidates both at the national and local levels have used the rhetoric of inter-ethnic intolerance for the purpose of negative mobilization ([Ezeibe, 2020](#)). Rumors attempting to dehumanize opponents and stoke fear of imminent terrorism and violence were spread by both the incumbent APC and the opposition PDP and rapidly diffused throughout social media. The misinformation and hate speech circulated predominantly through social media platforms such as Twitter and Facebook during this period of intense electioneering was of such grave concern that the APC-controlled Nigerian Senate quickly drafted a draconian

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<sup>10</sup> [Voice of America](#), “In Volatile Kenya, MP and Former Senator Detained Over Hate Speech Allegations”, <https://www.voanews.com/africa/volatile-kenya-mp-and-former-senator-detained-over-hate-speech-allegations> on November 24, 2020

<sup>11</sup> For similar accounts on the relationship between social media and mis/disinformation in the Latin American context, see [Lupu, Bustamante and Zechmeister \(2020\)](#), which briefly provides accounts for recent elections in Mexico, Brazil, El Salvador and Argentina.

<sup>12</sup> See <https://www.france24.com/en/video/20180322-cambridge-analytica-boasts-role-kenya-election> and <https://www.bbc.com/news/world-africa-43471707>. See SI Appendix Figure A4 for a screen capture of the video.

piece of legislation that levies severe punishment (death or life sentence) for those found guilty of engaging in hate speech.<sup>13</sup>

While the preceding anecdotes are by no means definitive from an evidentiary standpoint, they provide the context and motivation for why we suspect mobile internet access and social media platforms can encourage parochialism and potentially inhibit the emergence of an attachment to the national community. In subsequent sections, we proceed to describe in detail the research design that allows us to gather more systematic evidence as to the link between mobile communications technology expansion and national identities.

## 4 Data and research design

### 4.1 Geocoded public opinion data

To estimate the effect of new technology on national identification, we combine geocoded individual survey responses with data on the geographic extent of mobile internet coverage. We overlay these coverage maps with geocoded individual-level data from rounds 3–7 of the Afrobarometer Surveys, conducted between 2005 and 2018. As seen in Figure 3, the combined data include individuals from 27 sub-Saharan African countries.

Our main dependent variable is derived from responses to the Afrobarometer question:

*“Let us suppose that you had to choose between being a [respondent’s national ID] and being a [respondent’s ethnic group]. Which of the following best expresses your feelings?”*

Responses range from 1 (“I feel only [ethnic ID]”) to 5 (“I feel only [national ID]”). With this measure, the strength of national and ethnic identities are defined relative to one another. For our purposes, this is useful: we conceive of ethnic and national identities to be competing to some extent.<sup>14</sup> One implication, however, is that movement from, for example, “I feel more [national ID]

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<sup>13</sup>Deutsche Welle, “Nigeria bill aims at punishing hate speech with death”, retrieved at <https://www.dw.com/en/nigeria-bill-aims-at-punishing-hate-speech-with-death/a-51419750> on November 24, 2020

<sup>14</sup>Robinson (2014) has elaborated on the benefits of employing this relative measure of national identity; first, a question item probing absolute levels of national and ethnic identification separately would require us to assume that

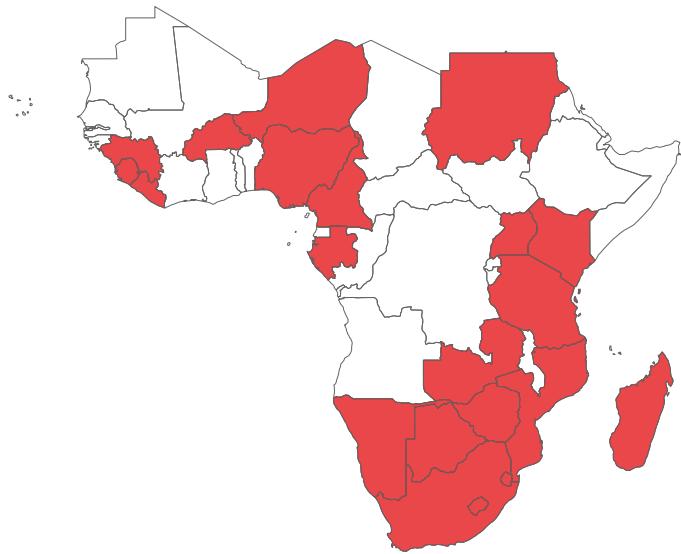


Figure 3: Countries included in the main analysis presented in the paper. To be included, a country needed to be in at least two Afrobarometer surveys for which mobile internet coverage data was available from the GSMA.

than [ethnic ID]” to “I feel equally [national ID] and [ethnic ID]” could represent a reduction in national identification, an increase in ethnic identification, or both. Figure 4 shows the distribution of responses among geolocated respondents in Afrobarometer rounds 3–7 in our difference-in-difference setup. Almost 40 percent of the sample reports that they identify exclusively with the nation. Our preferred outcome variable is an indicator for whether the respondent identifies more nationally than ethnically (i.e., a response of 4 or 5), which is true for 49% of the sample.

## 4.2 Mobile service coverage data

Data on the spatial extent of cell phone coverage is provided by Collins Bartholomew and the GSM Association, that compiles coverage data from network providers. These annual maps show the geographic extent of 2G and 3G cell phone coverage, representing the ability to make phone calls and send text messages (2G), or more comprehensive access to the internet or social media platforms

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respondents map intensity of identification onto the scale in similar ways. Second, the relative juxtaposition of national versus ethnic identities are in line with the constructivist notion of identities that individuals hold identifications with multiple identity groups and that relative salience of an identity vis-à-vis another is more important and meaningful than the strength of attachment to a single identity by itself.

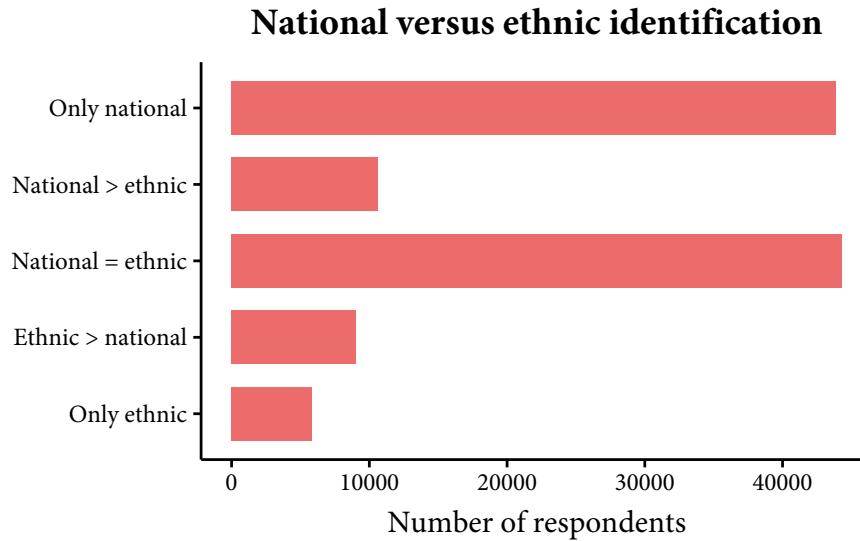


Figure 4: The distribution of national versus ethnic identification in Afrobarometer rounds 3–7. For our main outcome, we use an indicator for whether the respondent identifies more nationally than ethnically (i.e., “national identity” or “national > ethnic”).

and online messaging apps via mobile internet connections (3G). For our analysis, we choose the year of coverage data on a country-by-country basis, selecting the most recent coverage data that was collected prior to the beginning of that country’s survey. In most cases the most recent coverage data is reported less than a year prior to the survey launch.

Combining survey responses with mobile coverage spatial polygons allows us to locate respondents as within or outside of the extent of mobile coverage, as well as to measure individuals’ distances to the coverage boundary for the boundary design. Intuitively, mobile coverage is more prevalent in population-dense areas. For example, during Afrobarometer wave 5 (2011–2013), less than one third of the territory was covered, but seventy-nine percent of respondents lived in areas with cell phone coverage.

### 4.3 Difference-in-differences strategy

To analyze the effect of mobile internet coverage on national identity, we employ a difference-in-differences estimator using geographic data on mobile internet coverage and geocoded surveys with

the following specification:

$$y_{ijt} = \alpha + \beta \text{Covered}_{ijt} + \gamma \text{EverCovered}_i + \delta_j + \zeta_t + \theta X_{it} + \varepsilon_{ijt} \quad (1)$$

where  $y_{ijt}$  is an outcome for individual  $i$  in geographic area  $j$  in time period  $t$ .  $\text{Covered}_{ijt}$  is an indicator variable for whether the individual has mobile internet coverage at time  $t$ , and  $\text{EverCovered}_i$  is an indicator for whether individual  $i$  is in the treatment group—whether  $i$ 's location receives mobile internet during the period of our study.  $X_{it}$  represents a vector of individual covariates. Geographic area (country or district) fixed effects are represented by  $\delta_j$  and  $\zeta_t$  represents year fixed effects. We cluster standard errors by locality—the level at which mobile coverage is assigned.

We also test the role election proximity plays in moderating the effect of mobile internet access within the difference-in-differences framework by employing an identification strategy developed by Eifert, Miguel and Posner (2010). *Eifert et al.* exploited the fact that the dates on which *individual* interviews for the Afrobarometer surveys were implemented are likely to be determined orthogonally to the dates of the elections, which are determined by statutory provisions or decisions made by the electoral management body in each country. We therefore calculate the “number of months” between the date of a respondent’s interview and the closest presidential election in the respondent’s country. We then create an interaction term between the “months to election” measure and our treatment indicator for mobile internet coverage. While it is feasible that the implementation of the surveys may have been scheduled to coincide with national elections, *Eifert et al.* argue that the enormity of the tasks involved in implementing a nationally representative survey makes it especially difficult to do so. For our purposes, which include either country or district fixed effects that only exploits within country variation in the timing of surveys, there is no reason to expect that this fact to threaten the internal validity of the analysis.

To examine the role of election proximity in moderating the effects of mobile coverage, we modify equation 1 by interacting the coverage indicator with the number of months between the an individual’s survey date and the date of closest national election in the individual’s country.

## 5 Main Findings

### 5.1 The effect of mobile internet on national identity

Table 1 reports estimates of the effect of mobile internet coverage on a respondent identifying more nationally than ethnically using the difference-in-difference specification shown in equation 1. Column (1) reports results of a baseline specification without additional covariates, but with country fixed effects that allow us to tighten our inferences to within country variation in over-time mobile internet coverage expansion. In line with our expectations, this baseline specification shows that gaining access to mobile internet coverage *decreases* an individual's propensity to identify with the nation (over their tribe or ethnic group) by around 6 percentage points, statistically distinguishable from zero at conventional levels of significance. Column (2) presents specifications with individual-level demographic controls for gender, age, completion of secondary education, and whether the respondent's residence is classified as urban or rural by the Afrobarometer surveys added to the baseline specification. The inclusion of these individual-level covariates does little to change the substantive negative effect of mobile internet coverage.

Table 1: Effect of access to mobile internet on national identity

| Dependent variable:      |   |                      |                      |                      |                      |
|--------------------------|---|----------------------|----------------------|----------------------|----------------------|
|                          | Identify More Nationally Than Ethnically (Binary) |                      |                      |                      |                      |
|                          | (1)   | (2)                  | (3)                  | (4)                  | (5)                  |
| Mobile internet coverage | -0.061***<br>(0.011)                              | -0.066***<br>(0.011) | -0.057***<br>(0.010) | -0.066***<br>(0.011) | -0.057***<br>(0.010) |
| Fixed effects            | Country   | Country              | District             | Country              | District             |
| Demographic controls     | No  | Yes                  | Yes                  | Yes                  | Yes                  |
| Media controls           | No  | No                   | No                   | Yes                  | Yes                  |
| Observations             | 55,238  | 54,809               | 54,809               | 54,484               | 54,484               |

*Notes:* Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically. All specifications include fixed effects for survey wave and either country or district. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. *Media controls* includes individual-level measures of news consumption from newspapers, radio, and television as reported in the Afrobarometer surveys. Robust standard errors clustered at the locality level are shown in parentheses. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

While the robustness of the findings to the addition of these pretreatment demographic controls should assuage some inferential concerns, we further present specifications that restricts our inferences to smaller geographic units, based on the intuition that country fixed effects are insufficient to absorb the geographic heterogeneity. Column (3) employs district fixed effects in lieu of country fixed effects for the specification reported in column (2).<sup>15</sup> While the size of the coefficient decreases marginally from 6.6% points to 5.7% points, the mobile internet effects remain still strongly negative, statistically significant at  $p < 0.01$ .

To assuage concerns that the expansion of internet coverage may reduce citizens' news consumption via traditional media—newspapers, radio, and TV—and that these changes in tradition news consumption might be driving our results, specifications (4) and (5) add individual-level measures of news consumption from newspapers, radio, and television. News consumption from each of the three traditional media are reported in Afrobarometer surveys, each on a 5-point scale. It is important to note that in contrast to the demographic controls, news consumption is post-treatment. Therefore, including these controls may raise concerns over post-treatment bias, and should be interpreted with caution. The coefficients in columns (4) and (5) show little to no movement from the effects reported in columns (2) and (3).<sup>16</sup> Combined, we believe these results provide broad evidence in support of our argument that access to mobile internet coverage will increase polarization across existing parochial identities and prevent the emergence of a collective national identity.<sup>17</sup>

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<sup>15</sup>To create district-level dummies, we use the district (admin 1) boundaries from the 2008 Global Administrative Unit Layers spatial database, created by the Food and Agriculture Organization (FAO) of the United Nations. Use of 2008 boundaries for all our analyses ensures that the boundaries are pre-treatment and do not change over time.

<sup>16</sup>Table A2 and Table A3 in the SI Appendix provide the same specifications reported across columns (1)–(5) on alternative operationalizations of the outcome variable; i) on whether an individual identifies exclusively nationally, or ii) the raw 5 point scale. The findings are consistent and robust with those reported in Table 1.

<sup>17</sup>These results contrast starkly with the effect of basic mobile coverage, which we introduce in more detail as a placebo test, reported in Table A11 of the SI Appendix. The intuition behind presenting this placebo test is that our mechanism of mobile internet coverage exposing users to the polarizing influence of the internet and social media platforms cannot operate with basic cellular service. The magnitude of the effects reported in Table A11 are small and statistically indistinguishable from zero.

## 5.2 Mechanism: Elections and the intensification of polarization

Does proximity to elections moderate the effect of mobile internet coverage on national identity?

Our theoretical discussions highlighted the possibility that the polarizing nature of elections in Africa would intensify the negative effect of mobile internet coverage. In Table 2 and Figure 5, we put these ideas to the test in the difference-in-differences framework. We specifically estimate the same models from Table 1, but with an interaction term between the mobile internet coverage variable and the number of months between the date of the survey interview and the nearest presidential election in the respondent's country.

Table 2: Heterogeneity of the Effects of Access to Mobile Internet by Election Proximity

|  | <i>Dependent variable:</i>                        |                       |                       |                       |                       |
|--|---|-----------------------|-----------------------|-----------------------|-----------------------|
|  | Identify More Nationally Than Ethnically (Binary) |                       |                       |                       |                       |
|  | (1)   | (2)                   | (3)                   | (4)                   | (5)                   |
| Mobile internet coverage                           | -0.127***<br>(0.016)                              | -0.130***<br>(0.016)  | -0.128***<br>(0.015)  | -0.129***<br>(0.016)  | -0.128***<br>(0.015)  |
| Months from election                               | -0.003***<br>(0.0005)                             | -0.003***<br>(0.0005) | -0.003***<br>(0.0004) | -0.003***<br>(0.0005) | -0.003***<br>(0.0004) |
| Mobile internet coverage<br>× Months from election | 0.004***<br>(0.001)                               | 0.004***<br>(0.001)   | 0.004***<br>(0.001)   | 0.004***<br>(0.001)   | 0.004***<br>(0.001)   |
| Fixed effects                                      | Country   | Country               | District              | Country               | District              |
| Demographic controls                               | No  | Yes                   | Yes                   | Yes                   | Yes                   |
| Media controls                                     | No  | No                    | No                    | Yes                   | Yes                   |
| Observations                                       | 55,238  | 54,809                | 54,809                | 54,484                | 54,484                |

*Notes:* Difference in differences estimates of the heterogeneous effects of access to mobile internet on individuals' propensity to identify more nationally than ethnically by proximity to elections are shown. The positive interaction between mobile internet coverage and months from the election indicates that the effect of mobile internet on national identification gets more negative closer to elections. Standard errors clustered by locality are shown in parentheses.  
 \* $p<0.1$ ; \*\* $p<0.05$ ; \*\*\* $p<0.01$ .

Table 2 reports findings from these analyses. In line with our expectations, the effect of mobile internet service expansion is strongly moderated by the temporal distance to elections. Across different specifications reported in columns (1)~(5), the interaction terms remains positive and consistent, and is statistically distinguishable from zero at  $p<0.01$ . Substantively speaking, the magni-

tude of the coefficient means that an additional month closer to the election will decrease (since the months to election variable decreases as the election approaches) the proportion of individuals identifying with the nation by around 0.4 percentage points more in comparison to those without mobile internet coverage.

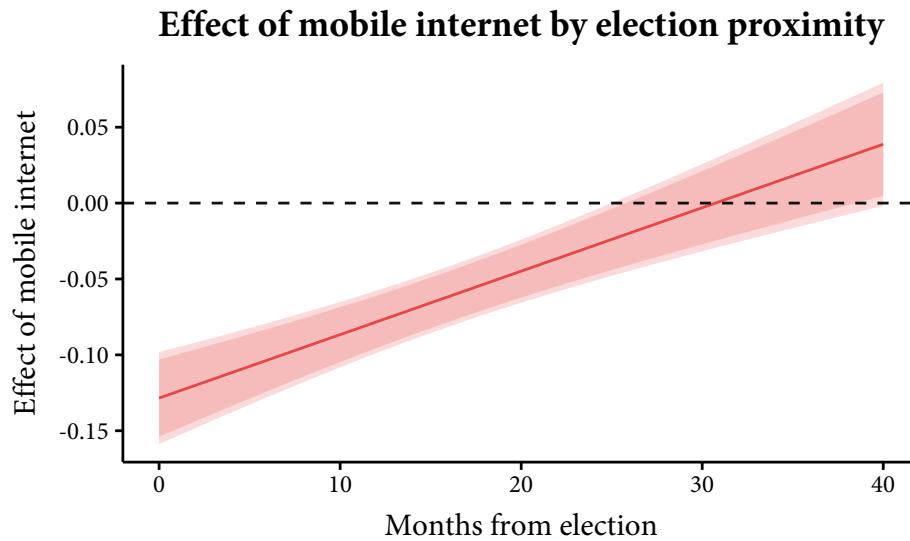


Figure 5: Heterogeneous effects of mobile internet on national identity by election proximity for specification (3) in Table 2. 90 and 95 percent confidence intervals clustered by locality are shown.

Figure 5 plots the estimated effect of mobile internet coverage on a respondent identifying more nationally than ethnically by time to the closest election. Results are shown for specification (3) in Table 2. For respondents surveyed far from elections, we observe no relationship between mobile internet access and national identification. However, the effect of mobile internet strengthens with election proximity and becomes statistically significant. For respondents within 10 months of an election (31.8 percent of the sample), access to mobile internet decreased national identity by over 9 percentage points.<sup>18</sup> This finding aligns with our theoretical argument that access to the polarizing influences of the internet during electoral campaigns, facilitated by mobile internet coverage, drives the negative effect of mobile technology on national identity.

<sup>18</sup>The average number of months until the closest election in our sample is 16.31 months and the maximum time between a respondent's interview and the closest election is 40.6 months. Figure A10 in the SI Appendix shows the distribution of the "months to election" variable.

### 5.3 Alternative Explanations

We have argued that mobile internet decreases attachment to national identities through an electoral mechanism. However, we might be concerned that the mechanism underlying our effect operates instead through the wealth-accumulating effects of mobile internet coverage or that it is the result of the expansion of mobile internet first into wealthier areas.

We evaluate several alternative explanations. First, access to mobile internet may have increased individual respondents' household wealth and *wealth*, rather than increased online polarization during elections, may be moderating the effects of mobile internet coverage. Access to mobile networks could increase individual or household income by lowering barriers to accessing information on prices and job or business opportunities ([Jensen, 2007](#); [Aker, 2008](#); [Aker and Mbiti, 2010](#)). If wealth also induces changes in identity, the wealth effects of mobile internet access might explain our results.

Second, there is the possibility that these results are driven by selective expansion of mobile internet coverage into wealthier areas. Mobile internet (3G and 4G) antennas have a shorter range than does basic 2G mobile service. Therefore, profit motivated mobile network providers are most likely to first provide mobile internet coverage in wealthy urban areas. Cell towers require electricity and road access for maintenance, so individuals far from roads or electrical transmission lines are less likely to have mobile internet coverage.

Third, mobile internet coverage may simply accompany a broader modernization process. Economic development may lead to changes in identity, even if it does not substantially change an individual's personal wealth. While modernization theory identified economic development as an impetus toward forming broader identities, including national ones ([Rostow, 1960](#); [Robinson, 2014](#)), a number of scholars of African politics have identified development as a source of increased ethnic competition and polarization ([Bates, 1974](#); [Posner, 2004](#)). This could lead to a spurious finding, when instead ethnic polarization is the result of economic development. We explore evidence for these alternative theoretical explanations in Table 3.

To address the possibility that wealth is responsible for the effect of mobile internet on iden-

Table 3: Effect of access to mobile internet is not driven by modernization and local development

|                          | Identify More Nationally Than Ethnically (Binary) |                      |                      |                      |                      |                      |                      |                      |
|--------------------------|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                          | Dependent variable:                               |                      |                      |                      |                      |                      |                      |                      |
|                          | (1)   | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                  | (8)                  |
| Mobile internet coverage | -0.067***<br>(0.011)                              | -0.058***<br>(0.010) | -0.067***<br>(0.011) | -0.059***<br>(0.010) | -0.068***<br>(0.011) | -0.059***<br>(0.010) | -0.073***<br>(0.011) | -0.061***<br>(0.010) |
| Fixed effects            |   |                      |                      |                      |                      |                      |                      |                      |
| Demographic controls     | Yes   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Wealth controls          | Yes   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Population controls      | No  | No                   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Infrastructure controls  | No  | No                   | No                   | No                   | No                   | Yes                  | Yes                  | Yes                  |
| Night lights controls    | No  | No                   | No                   | No                   | No                   | No                   | Yes                  | Yes                  |
| Observations             | 54,303  | 54,303               | 54,172               | 54,172               | 54,172               | 54,172               | 54,172               | 54,172               |

*Notes:* The specifications shown above include a battery of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. *Wealth controls* include an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, tv, or motor vehicle. We include an index created from the dichotomous measure of each asset ownership. *Population controls* include subnational measures of population density ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *nightlight controls*, we use harmonized annual composites of nighttime luminosity from the the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality level are shown in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

ity, specifications (1) and (2) in Table 3 include a measure individual wealth derived from asset ownership as reported in the Afrobarometer surveys. It consists of an additive index of indicators of whether a survey respondent's household owns a radio, a television, and a motor vehicle. Our estimates of the effect of mobile internet when controlling for household wealth are a similar magnitude and level of significance to estimates from Table 1. As further test of wealth as an alternate explanation we conduct a placebo test using the wealth index as the dependent variables in the same difference-in-differences framework. Results, shown in Table A12, suggest that in this context mobile internet coverage does not increase respondents' wealth, a necessary part of this alternate mechanism.

It is important to address the selective expansion of mobile internet coverage. The difference-in-differences design alleviates some of this concern, but selective expansion could be driving our results if respondents who live in areas that get mobile internet coverage would have become more ethnically polarized in the absence of mobile internet compared to people who live in areas that do not get. Perhaps national identity would have decreased in dense urban areas, but not in rural areas. To address this we control for population density in specifications (3) and (4). Time-varying sub-national measures of population density are from Oak Ridge National Laboratory's LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery ([Dobson et al., 2000](#)). We also include covariates controlling for geographic distance between a respondent's home and both the road network and the electrical transmission grid in specifications (5) and (6). These are important determinants of mobile internet coverage because cell towers require electricity and road access. We constructed these measures by calculating the geodesic distance between every respondent and the closest points on the road network and electricity grids. Geographic data on African road networks is from the Socioeconomic Data and Applications Center (SEDAC) ([CIESIN](#)) and data on African electricity grids comes from the Africa Infrastructure Country Diagnostic ([AICD, N.d.](#)). Inclusion of these covariates does not substantially change the point estimates or statistical significance of mobile internet coverage.

Broader economic development could potentially lead to changes in identity. Mobile internet might be acting as a proxy for economic development and lead to a spurious result. To address this concern we add time-varying controls for nighttime lights in specifications (7) and (8). Nighttime lights are often used to measure local economic activity. We use harmonized annual composites of nighttime luminosity from the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite ([Li et al., 2020](#)). If economic development is the reason for the effect of mobile internet on identity, we would expect the effect of mobile internet coverage to disappear—or at least be reduced—when controlling for nighttime lights. Instead, the estimated effect of mobile internet on national identity is slightly stronger, so it is unlikely that economic development is driving our results.

## 6 Robustness and Placebo Tests

We conduct a number of robustness checks and placebo tests. We first investigate the parallel trends assumption that we rely on for our difference-in-differences design. In addition, we conduct several placebo test, including for the effect of basic mobile coverage, which does not allow access to social media and internet-based messaging services. Finally, we apply an alternative research design that uses the boundary of mobile internet coverage to further validate our main findings from the difference-in-difference design.

### 6.1 Parallel trends

The difference-in-differences estimator relies on the assumption of parallel trends—that national identification in treated and untreated areas would have followed similar patterns absent treatment. Though this assumption is untestable, its plausibility is often assessed using pre-treatment trends. Differential trends between treatment and control groups prior to actual changes in coverage would suggest that differential trends during the treatment period could be driven by other factors. For in-

stance, one alternative explanation for our finding of decreased national identification is that mobile internet providers expand coverage into wealthy areas, and that this economic development itself, rather than mobile coverage, causes decreases in national identification. We test whether differences in national identity precede changes in coverage by estimating equation 1 with the addition of one and two period leads to the treatment variable. That is, we include respondent's treatment status for the survey waves that occur *after* after the actual interview. Results are shown in SI Appendix Table A10. In all specifications the effect of mobile internet coverage on a respondent identifying more nationally than ethnically remains negative and statistically significant at conventional levels. Coefficients for the *leads* of mobile internet coverage, representing the effect of *future mobile internet coverage* on national identity, have point estimates near zero and is not significant at conventional levels. These results suggest that national identification does not anticipate mobile coverage, which we interpret to mean that our findings are not the result of mobile coverage expanding into more affluent areas.

## 6.2 Basic mobile coverage placebo

Our posited mechanisms for mobile internet fails to extend to the case of basic mobile phone service—which provides users with “talk and text” capabilities—because it does not grant access to online social media platforms nor internet-based messaging apps such as Whatsapp or Telegram. Basic mobile service otherwise shares many similarities with mobile internet coverage. Basic mobile coverage is also more likely to be deployed earlier in denser, wealthier areas and wealthier people may be able to use it more frequently. Many of the alternative mechanisms discussed in section 5.3 could also potentially apply to basic mobile phone service. Therefore, we use the effect of basic mobile coverage as a placebo test. Though mobile internet and basic mobile coverage use different technologies and extend different distances, equipment to provide mobile internet coverage is often added to existing cell towers providing basic mobile service. This causes mobile internet coverage and basic mobile service to be spatially correlated. To avoid confounding from mobile internet we restrict the placebo to survey waves prior to the introduction of mobile internet in a country. The

results are shown in SI Appendix Table A11. All point estimates are close to zero and are not significant at conventional levels. This placebo test bolsters our confidence that we have estimated the effect mobile internet and our results are not due to the selective provision of mobile coverage.

### 6.3 Non-democracies placebo

Our proposed mechanism relies on politicians mobilizing along ethnic lines during political campaigns. This commonly happens even in countries that are not fully democratic, as long as opposition politicians are allowed to campaign. However, in states in which lack any form of political contestation, whether because of a lack of elections or a lack of remaining political opposition, we do not expect our proposed mechanism to hold. To test this, we conduct a placebo test by estimating the difference-in-differences design on a subset of only the least democratic countries in our sample: Sudan and Swaziland. In this time period both countries lacked significant political contestation. Table A13 in the SI Appendix shows the estimated effect of mobile internet on national identity for these non-demographic countries. Limiting the data to just these countries substantially reduces the sample size, so there is a concern that null effects are caused by the small sample size. However, the point estimates are very close to zero. This provides additional evidence that the effect of mobile internet on national identity operates through electoral politics.

### 6.4 Additional validation: An extension with a boundary design

In addition to robustness and placebo tests presented in the preceding paragraphs, we also leverage an alternate research design that uses the boundary of mobile internet coverage, comparing individuals with and without access to mobile internet residing within different bandwidths around the boundary of mobile phone coverage. The boundary of mobile internet coverage is a function of the location of cell towers and terrain. Importantly, the mobile internet coverage boundary does not correspond to the borders of administrative units, where other policies and political histories may change discontinuously. However, a geographic regression discontinuity design as in Keele and Titiunik (2015) is not appropriate because the coverage boundary does not represent a sharp

discontinuity in mobile phone ownership and usage. Individuals living in areas without coverage that are nonetheless *near* the coverage boundary do have some access to mobile networks as they travel in and out of coverage boundaries as they go about their daily lives, but they have *less* access to mobile networks than individuals living in covered areas.

We estimate the effect of mobile phone coverage on national identity using the following specification, comparing the national identity of respondents on either side of the mobile internet coverage boundary:

$$y_{ijt} = \alpha + \beta \text{Covered}_i + \delta_{jt} + \xi W_i + \theta X_{ij} + \varepsilon_{ijt} \quad (2)$$

where  $y_{ijt}$  is an outcome for individual  $i$  in geographic area  $j$  in time period  $t$  and  $\text{Covered}_i$  is an indicator variable for whether the individual has mobile internet coverage. The border design is cross-sectional, so we include country-wave fixed effects, designated  $\delta_{jt}$ . A flexibly estimated expansion of latitude and longitude,  $W_i$  is also included. Again we cluster standard errors at the locality level. For the cross boundary comparison to be possible, there must be sufficient numbers of respondents in a country-wave on either side of the boundary—with and without coverage. Therefore, we restrict the boundary analysis to country-waves in which at least 10 respondents have mobile internet coverage and at least 10 respondents do not have coverage.

Figure 6 graphically reports the results, showing the difference in national identity for respondents with and without coverage residing near the coverage boundary for a wide range of bandwidths. This shows differences in the propensity to identify more nationally than ethnically in bandwidths that include all individuals between 0 and 5 km of the coverage boundary to all individuals between 0 and 100 km of the coverage boundary. These results show a lower level of national identification for individuals with mobile internet coverage. The magnitude of the point estimates decreases for smaller bandwidths, consistent with the coverage boundaries not representing sharp discontinuities in actual mobile internet usage. However, point estimates remain negative and statistically significant over a broad spectrum of bandwidths.

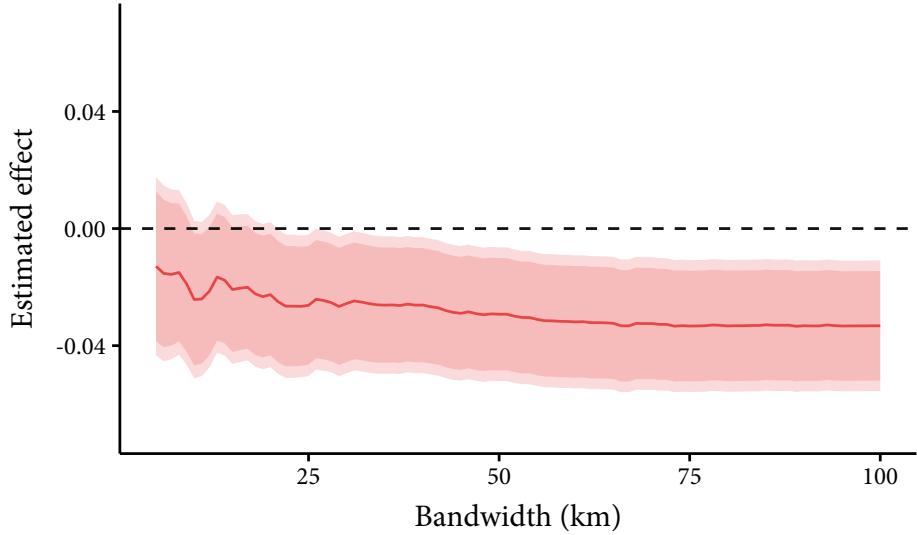


Figure 6: Results of the boundary analysis, showing how the propensity to identify more nationally than ethnically varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

## 7 Conclusion and Implications

The expansion of mobile communications infrastructure has been heralded as one of the most transformative innovations of the past century. Whereas the reach of other landmark technological advances is believed to have been relatively limited in the Global South, academics and practitioners alike have shown that cell phone coverage is having a profound impact on these developing societies; on how day-to-day economic transactions are being handled (Suri and Jack, 2016; Aron, 2018) as well as how individuals engage in contentious collective action against the state (Pierskalla and Hollenbach, 2013).

In this paper, we have empirically investigated what effect the expansion of mobile internet coverage has on another salient and important dimension in sociopolitical life: the extent to which individuals in sub-Saharan Africa share a sense of belonging or attachment to their national community. Leveraging over-time variation in mobile internet coverage in the context of a difference-in-difference design, and exploiting spatial variation in a geographic boundary design, we demonstrated that those with mobile coverage are significantly less likely to identify with their broader national community and significantly more likely to identify with their ethno-communal groups.

The results are robust with respect to each identification strategy, and cannot be attributed to alternative causal channels other than through the increased use and ownership of cell phones. In addition, we tested the plausibility of the electoral mechanism we posited for the mobile internet effect by exploiting exogenous variation in the proximity of a survey respondent's interview date to the presidential election; our results showed that, as expected, the proximity to elections moderates the effect of mobile internet coverage.

Our findings provide some important avenues for extension. First, further analysis of the mechanisms underlying the negative relationship between cell phone coverage and national identification is warranted. Our approach in testing for the electoral mechanism is based on the assumption that the dissemination of such polarizing information is likely to increase as a function of proximity to the elections, which we were ultimately unable to test in the context of this paper. Future research should therefore attempt to validate this assumption by examining both the nature of the information and rhetoric disseminated through mobile cell phone networks, and how it evolves as elections approach.

Second, further analysis into the generalizability of our findings is also necessary. Our results are restrictive in the sense that we are only examining the effects of cell phone coverage on a relatively recent time period on a sample of citizens in sub-Saharan African countries. While we presented evidence that the effect of mobile internet on national identification depends on the level of political contestation during elections, it is unclear whether there might be other heterogeneous effects across different time periods and geographical contexts. For example, is the relationship between cell phone coverage and national identification similar across both the nascent stages of cell phone expansion (early 2000s) and later stages in which cell phones are much more ubiquitous?<sup>19</sup> How do the effects of cell phone coverage vary across contexts in which politics are organized along different social cleavages (ethnicity versus class)? An attempt to examine this effect with more data spanning a longer time period and covering different regions of the world would provide more confidence as to the temporal and geographic external validity of these findings.

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<sup>19</sup>Our round-by-round analysis of the effects suggests that they are, but results are constrained by the fact that we have a relatively small sample size for the earlier rounds of the Afrobarometer).

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# Appendix for "Mobile Communication Technology and National Identity in Sub-Saharan Africa"

## A.1 Geographic and temporal extent of data

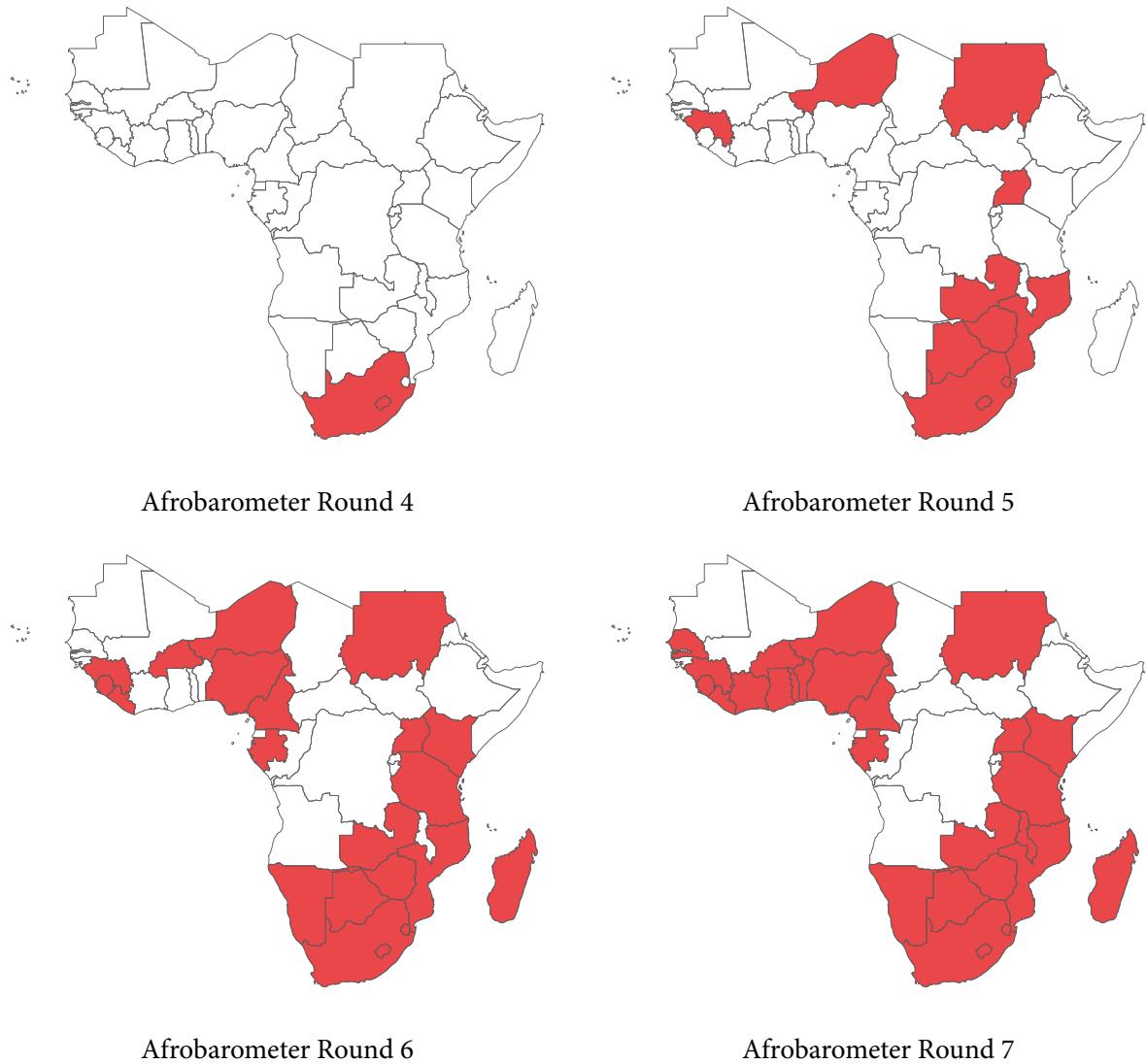


Figure A1: Countries included in each Afrobarometer survey round for which mobile internet coverage data is available from the GSMA.



Figure A2: Mobile internet has shown tremendous growth in Sub-Saharan Africa since 2008. The number of mobile internet subscriptions per 100 inhabitants is shown between 2008 and 2019 using data from the International Telecommunications Union. Mobile internet subscriptions increased in every country in Sub-Saharan Africa except Eritrea.

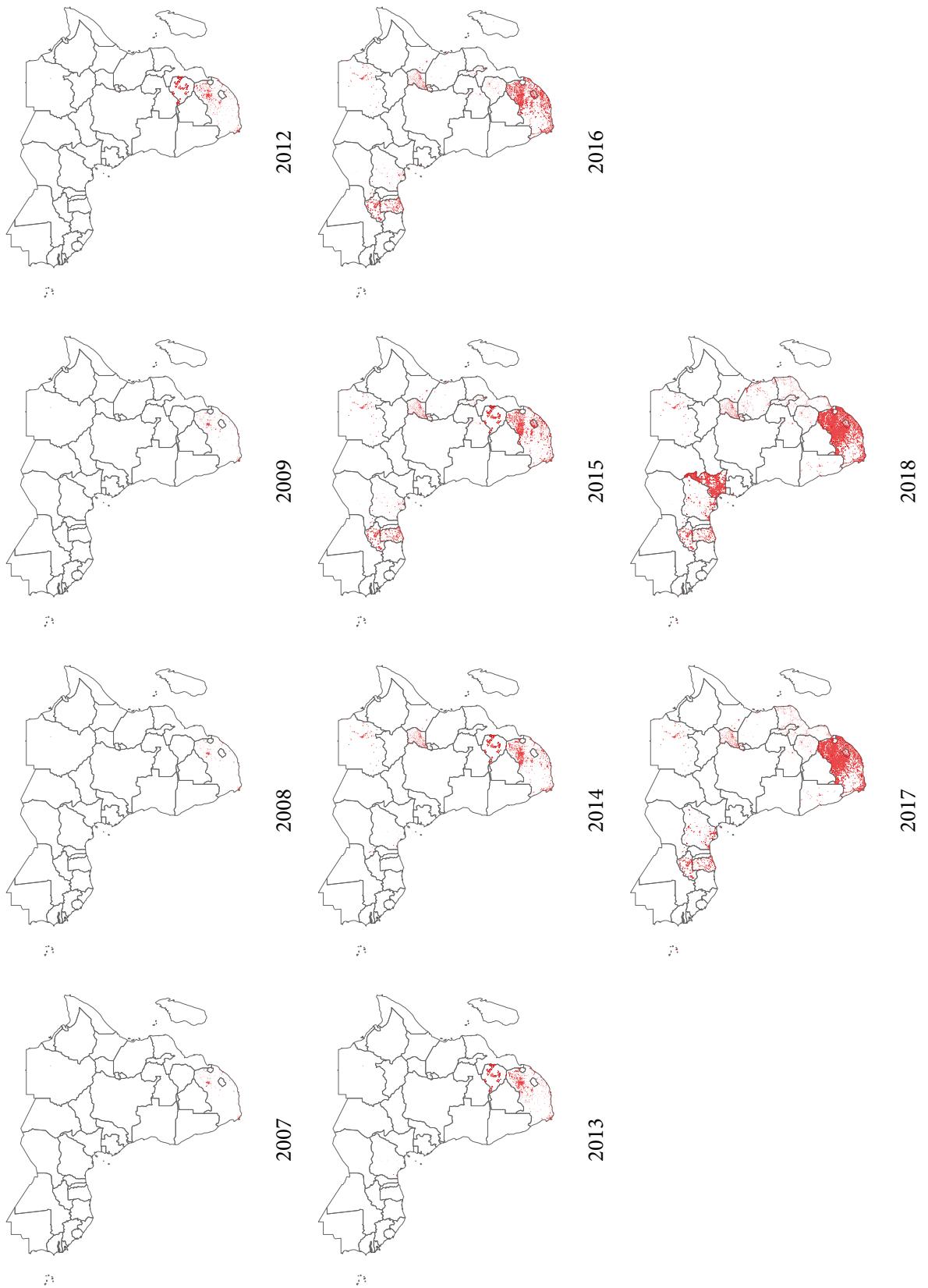


Figure A3: The expansion of mobile internet connectivity in sub-Saharan Africa between 2007 and 2018.

## A.2 Context: Social Media in Africa



Figure A4: Screen capture of propaganda video that circulated on social media targeting Kenya's opposition presidential candidate Raila Odinga in the run-up to the 2017 elections. The production of the video has not been formally tied to any organization or individual, but is largely believed to have been created by the firm Cambridge Analytica and disseminated by incumbent president Uhuru Kenyatta's campaign.

## A.3 Heterogeneous effects

Table A1 shows results for by demographic groups, including gender, urban/rural, age, and education. Estimates are similar across these groups, indicating that none of these demographic groups are driving the results.

## A.4 Alternate dependent variables

In the main body of the paper we show results in which our main outcome of interest is a respondent answering that they feel a stronger national than ethnic identity. As described in the main body of the paper, this variable was constructed from a question asking "Let us suppose that you had to choose between being a [respondent's national ID] and being a [respondent's ethnic group]. Which of the following best expresses your feelings?" Responses range from 1 ("I feel only [ethnic ID]") to 5 ("I feel only [national ID]"). Our preferred outcome variable is an indicator for whether the respondent identifies more nationally than ethnically: a response of 4 or 5. The strength of national (versus ethnic) identity could be measured other ways. Here we show results for two alternate measures of national identity constructed from the same survey question. Tables A2, A4 and A6 show results which require a higher standard for national identity. The regression models are otherwise

Table A1: Effect of access to mobile internet on national identity by demographic group

|                          | <i>Dependent variable:</i>                        |                      |                      |                      |                      |                      |                      |                      |
|--------------------------|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                          | Identify More Nationally Than Ethnically (Binary) |                      |                      |                      |                      |                      |                      |                      |
|                          | Female  | Male                 | Urban                | Rural                | Young                | Old                  | Sec ed               | No sec ed            |
|                          | (1)   | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                  | (8)                  |
| Mobile internet coverage | -0.059***<br>(0.012)                              | -0.064***<br>(0.013) | -0.045***<br>(0.016) | -0.080***<br>(0.015) | -0.062***<br>(0.013) | -0.059***<br>(0.013) | -0.065***<br>(0.016) | -0.057***<br>(0.012) |
| Fixed effects            | Country<br>No                                     | Country<br>No        | Country<br>No        | Country<br>No        | Country<br>No        | Country<br>No        | Country<br>No        | Country<br>No        |
| Demographic controls     | 27,721  | 27,510               | 24,009               | 31,229               | 26,315               | 28,673               | 19,329               | 35,735               |
| Observations             |   |                      |                      |                      |                      |                      |                      |                      |

*Notes:* Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically for different demographic groups. Results are shown for subsets of respondents by four demographic characteristics. Columns 1 and 2 show results by gender. Columns 3 and 4 show results for respondents residing in urban and rural areas. Columns 5 and 6 show results for respondents below and above (or at least) the median respondent age of 33. Columns 7 and 8 show results for respondents who have and have not completed secondary education. Robust standard errors clustered at the locality level are shown in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

similar to those shown in Tables 1, 2, and 3, but use whether an individual identifies only nationally (i.e., a response of 5 to the survey question above) as the dependent variable. Tables A3, A5 and A7 show estimates of the same specifications the raw 5-point scale as the dependent variable.

Table A2: Effect of Access to Mobile Internet on National Identification (Only National Identification)

|                          | <i>Dependent variable:</i>        |                      |                      |                      |                      |
|--------------------------|-----------------------------------|----------------------|----------------------|----------------------|----------------------|
|                          | Identify only nationally (binary) |                      |                      |                      |                      |
|                          | (1)                               | (2)                  | (3)                  | (4)                  | (5)                  |
| Mobile internet coverage | −0.072***<br>(0.012)              | −0.076***<br>(0.012) | −0.069***<br>(0.010) | −0.075***<br>(0.012) | −0.068***<br>(0.010) |
| Fixed effects            | Country                           | Country              | District             | Country              | District             |
| Demographic controls     | No                                | Yes                  | Yes                  | Yes                  | Yes                  |
| Media controls           | No                                | No                   | No                   | Yes                  | Yes                  |
| Observations             | 55,238                            | 54,809               | 54,809               | 54,484               | 54,484               |

*Notes:* Difference in differences estimates of the effect of access to mobile internet on individuals' propensity to identify nationally and not ethnically are shown. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is an indicator for individuals who identify only nationally, not ethnically. All models include fixed effects for survey wave and either country or district. Models (2)-(5) also include covariates for gender, age, urban/rural status, and an indicator for whether the individual has completed secondary school. Models (4) and (5) also control for consumption of news from newspapers, radio, and television. Standard errors clustered by locality are shown are in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Table A3: Effect of Access to Mobile Internet on National Identification (5-point scale)

| <i>Dependent variable:</i>                      |                      |                      |                      |                      |                      |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|
| National versus ethnic identity (5-point scale) |                      |                      |                      |                      |                      |
|   | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  |
| Mobile internet coverage                        | −0.148***<br>(0.026) | −0.166***<br>(0.026) | −0.147***<br>(0.024) | −0.164***<br>(0.026) | −0.146***<br>(0.024) |
| Fixed effects                                   | Country              | Country              | District             | Country              | District             |
| Demographic controls                            | No                   | Yes                  | Yes                  | Yes                  | Yes                  |
| Media controls                                  | No                   | No                   | No                   | Yes                  | Yes                  |
| Observations                                    | 55,238               | 54,809               | 54,809               | 54,484               | 54,484               |

*Notes:* Difference in differences estimates of the effect of access to mobile internet on individuals' national identity are shown. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is a five point scale ranging from 1, for individuals who identify fully ethnically, to 5, for individuals who identify fully nationally. All models include fixed effects for survey wave and either country or district. Models (2)-(5) also include covariates for gender, age, urban/rural status, and an indicator for whether the individual has completed secondary school. Models (4) and (5) also control for consumption of news from newspapers, radio, and television. Standard errors clustered by locality are shown are in parentheses. \* $p<0.1$ ; \*\* $p<0.05$ ; \*\*\* $p<0.01$ .

Table A4: Heterogeneity of the Effects of Access to Mobile Internet by Election Proximity (Only National Identification)

| <i>Dependent variable:</i>                         |                       |                       |                       |                       |                       |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Identify only nationally (binary)                  |                       |                       |                       |                       |                       |
|  | (1)                   | (2)                   | (3)                   | (4)                   | (5)                   |
| Mobile internet coverage                           | −0.140***<br>(0.017)  | −0.142***<br>(0.017)  | −0.145***<br>(0.016)  | −0.141***<br>(0.017)  | −0.143***<br>(0.016)  |
| Months from election                               | −0.003***<br>(0.0005) | −0.003***<br>(0.0005) | −0.003***<br>(0.0004) | −0.003***<br>(0.0005) | −0.003***<br>(0.0004) |
| Mobile internet coverage<br>× Months from election | 0.004***<br>(0.001)   | 0.004***<br>(0.001)   | 0.005***<br>(0.001)   | 0.004***<br>(0.001)   | 0.005***<br>(0.001)   |
| Fixed effects                                      | Country               | Country               | District              | Country               | District              |
| Demographic controls                               | No                    | Yes                   | Yes                   | Yes                   | Yes                   |
| Media controls                                     | No                    | No                    | No                    | Yes                   | Yes                   |
| Observations                                       | 55,238                | 54,809                | 54,809                | 54,484                | 54,484                |

*Notes:* Difference in differences estimates of the heterogeneous effects of access to mobile internet on individuals' propensity to identify nationally and not ethnically are shown. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is an indicator for individuals who identify only nationally, not ethnically. Standard errors clustered by locality are shown are in parentheses. \* $p<0.1$ ; \*\* $p<0.05$ ; \*\*\* $p<0.01$ .

Table A5: Heterogeneity of the Effects of Access to Mobile Internet by Election Proximity (5-point scale)

|  | <i>Dependent variable:</i>                      |                      |                      |                      |                      |
|--|---|----------------------|----------------------|----------------------|----------------------|
|  | National versus ethnic identity (5-point scale) |                      |                      |                      |                      |
|  | (1)   | (2)                  | (3)                  | (4)                  | (5)                  |
| Mobile internet coverage                           | -0.321***<br>(0.039)                            | -0.331***<br>(0.039) | -0.344***<br>(0.037) | -0.327***<br>(0.038) | -0.341***<br>(0.037) |
| Months from election                               | -0.006***<br>(0.001)                            | -0.006***<br>(0.001) | -0.007***<br>(0.001) | -0.006***<br>(0.001) | -0.007***<br>(0.001) |
| Mobile internet coverage<br>× Months from election | 0.011***<br>(0.002)                             | 0.010***<br>(0.002)  | 0.012***<br>(0.002)  | 0.010***<br>(0.002)  | 0.012***<br>(0.002)  |
| Fixed effects                                      | Country   | Country              | District             | Country              | District             |
| Demographic controls                               | No  | Yes                  | Yes                  | Yes                  | Yes                  |
| Media controls                                     | No  | No                   | No                   | Yes                  | Yes                  |
| Observations                                       | 55,238  | 54,809               | 54,809               | 54,484               | 54,484               |

*Notes:* Difference in differences estimates of the heterogeneous effects of access to mobile internet on individuals' national identity. These results use an alternate measure of national identity as the dependent variable. Here the dependent variable is a five point scale ranging from 1, for individuals who identify fully ethnically, to 5, for individuals who identify fully nationally. Standard errors clustered by locality are shown in parentheses. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

## A.5 Effect on mobile phone ownership and use

A necessary condition of the mechanism we propose is that mobile internet coverage must cause an increase in use of mobile internet. Although we are unable to test this idea directly, we instead evaluate the effect of mobile internet coverage on mobile phone ownership, mobile phone use, and where a respondent has a mobile internet subscription. Of these, mobile phone ownership is most weakly linked to our mechanism. This is because basic mobile phone can be used by respondents to talk and text who do not use mobile internet. Using a mobile phone daily is potentially more closely linked to our proposed mechanism, because the ability to use a phone for things other than talk or text may lead to more use. Whether a respondent has a mobile internet subscription is most closely linked to our mechanism, but data on this outcome is only available in Afrobarometer round 7, so we cannot use in a difference in differences design. SI Appendix Table ?? shows difference-in-differences estimates of the effect of mobile internet on mobile phone ownership and use. Specifications with and without a one period lead are shown. Results indicate that that mobile internet coverage causes an increase in increase in daily use of mobile phones, but the effect on mobile phone ownership is more ambiguous. Future mobile coverage does not appear to affect mobile phone ownership or use. SI Appendix Figures A5, A6, A7, A8, and A9 show boundary analysis results within a variety of bandwidths from the mobile internet coverage boundary, estimating the effect of mobile internet coverage on having a mobile internet subscription, getting news from social media such as Facebook or Twitter, getting news from the internet, using a mobile phone daily, and owning a mobile phone.

Table A6: Effect of access to mobile internet is not driven by modernization and local development (National identity only)

|                          | Dependent variable:               |                      |                      |                      |                      |                      |                      |                      |
|--------------------------|-----------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                          | Identify only nationally (binary) |                      |                      |                      |                      |                      |                      |                      |
|                          | (1)                               | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                  | (8)                  |
| Mobile internet coverage | -0.076***<br>(0.012)              | -0.070***<br>(0.010) | -0.076***<br>(0.012) | -0.070***<br>(0.010) | -0.076***<br>(0.012) | -0.070***<br>(0.010) | -0.082***<br>(0.012) | -0.071***<br>(0.010) |
| Fixed effects            |                                   |                      |                      |                      |                      |                      |                      |                      |
| Demographic controls     | Yes                               | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Wealth controls          | Yes                               | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Population controls      | No                                | No                   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Infrastructure controls  | No                                | No                   | No                   | No                   | No                   | Yes                  | Yes                  | Yes                  |
| Night lights controls    | No                                | No                   | No                   | No                   | No                   | No                   | Yes                  | Yes                  |
| Observations             | 54,303                            | 54,303               | 54,172               | 54,172               | 54,172               | 54,172               | 54,172               | 54,172               |

Notes: These results use an alternate measure of national identity as the dependent variable: an indicator for individuals who identify only nationally, not ethnically. The specifications shown above include a battery of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. *Wealth controls* include an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, TV, or motor vehicle. We include an index created from the dichotomous measure of each asset ownership. *Population controls* include subnational measures of population density ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *nightlight controls*, we use harmonized annual composites of nighttime luminosity from the the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality level are shown in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Table A7: Effect of access to mobile internet is not driven by modernization and local development (5-point scale)

|                          | Dependent variable:                             |                      |                      |                      |                       |                      |                      |                      |
|--------------------------|---|----------------------|----------------------|----------------------|-----------------------|----------------------|----------------------|----------------------|
|                          | National versus ethnic identity (5-point scale) |                      |                      |                      |                       |                      |                      |                      |
|                          | (1)   | (2)                  | (3)                  | (4)                  | (5)                   | (6)                  | (7)                  | (8)                  |
| Mobile internet coverage | -0.167***<br>(0.026)                            | -0.150***<br>(0.024) | -0.168***<br>(0.026) | -0.152***<br>(0.024) | -0.1170***<br>(0.026) | -0.152***<br>(0.024) | -0.187***<br>(0.026) | -0.159***<br>(0.024) |
| Fixed effects            | Country   | District             | Country              | District             | Country               | District             | Country              | District             |
| Demographic controls     | Yes   | Yes                  | Yes                  | Yes                  | Yes                   | Yes                  | Yes                  | Yes                  |
| Wealth controls          | Yes   | Yes                  | Yes                  | Yes                  | Yes                   | Yes                  | Yes                  | Yes                  |
| Population controls      | No  | No                   | Yes                  | Yes                  | Yes                   | Yes                  | Yes                  | Yes                  |
| Infrastructure controls  | No  | No                   | No                   | No                   | Yes                   | Yes                  | Yes                  | Yes                  |
| Night lights controls    | No  | No                   | No                   | No                   | No                    | No                   | Yes                  | Yes                  |
| Observations             | 54,303  | 54,303               | 54,172               | 54,172               | 54,172                | 54,172               | 54,172               | 54,172               |

*Notes:* These results use an alternate measure of national identity as the dependent variable: a five point scale ranging from 1, for individuals who identify fully ethnically, to 5, for individuals who identify fully nationally. The specifications shown above include a battery of covariates to demonstrate that the effect of access to mobile internet on national identity is not driven by modernization or local development. *Wealth controls* include an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, TV, or motor vehicle. We include an index created from the dichotomous measure of each asset ownership. *Population controls* include subnational measures of population density ORNL's annual LandScan datasets on population distribution which, in addition to census data, incorporate locations of known settlements and data on land cover derived from high resolution imagery (Dobson et al., 2000). *Infrastructure controls* include distance to the electricity grid and distance to the nearest road. For *nightlight controls*, we use harmonized annual composites of nighttime luminosity from the Defense Meteorological Satellite Program's Operational Linescan System and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership satellite (Li et al., 2020). Robust standard errors clustered at the locality level are shown in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Results indicate that mobile internet coverage causes a significant increase in all five outcomes.

*Dependent variable:* Mobile internet subscription

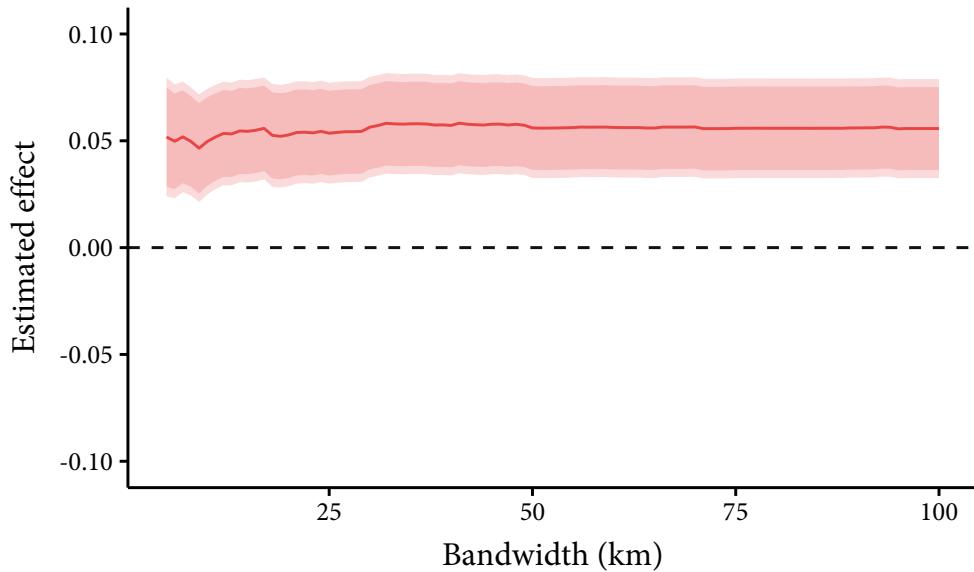


Figure A5: Results of the boundary analysis, showing how the propensity of a respondent to have a mobile internet subscription varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

*Dependent variable:* News from social media

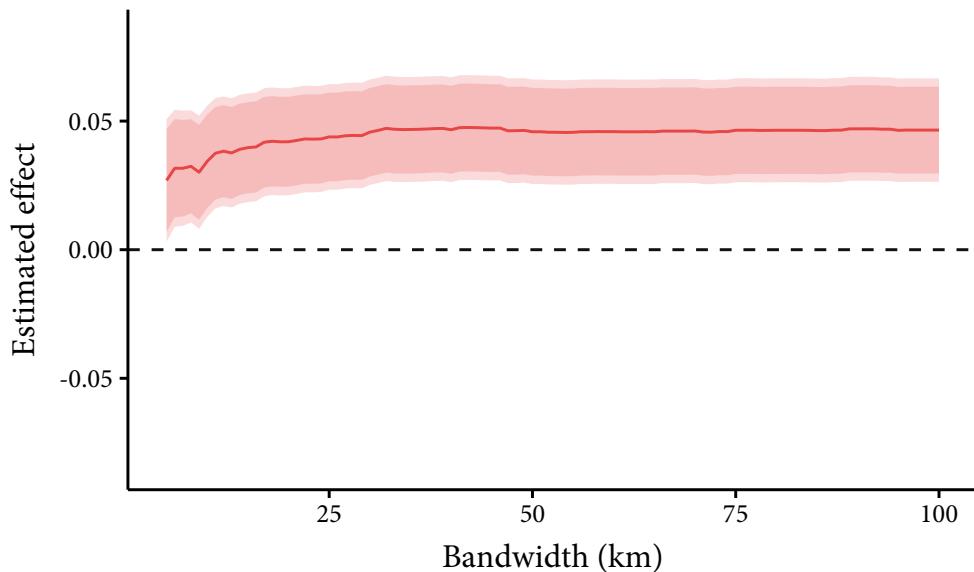


Figure A6: Results of the boundary analysis, showing how the propensity of a respondent to get news from social media varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

*Dependent variable:* News from internet

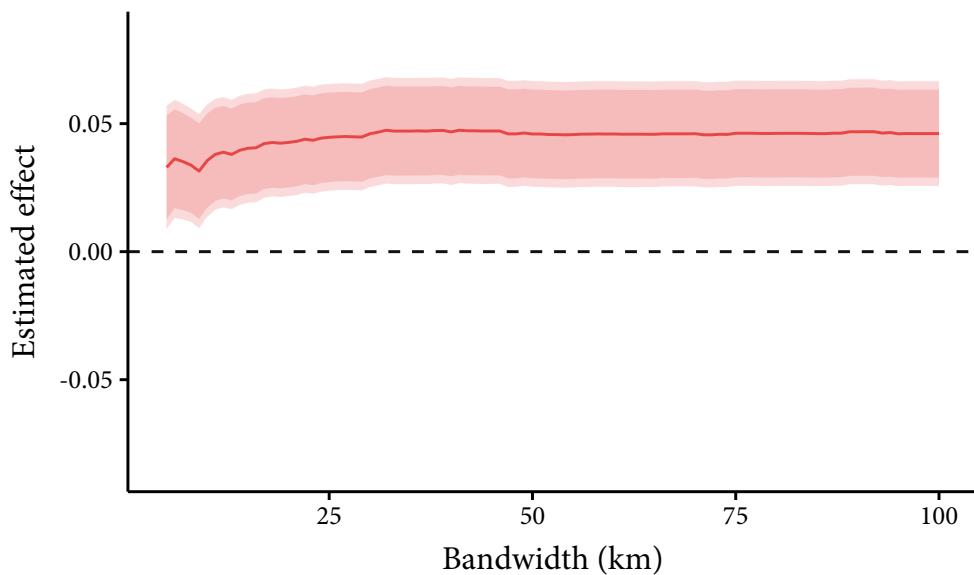


Figure A7: Results of the boundary analysis, showing how the propensity of a respondent to get news from the internet varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

*Dependent variable:* Use mobile phone daily

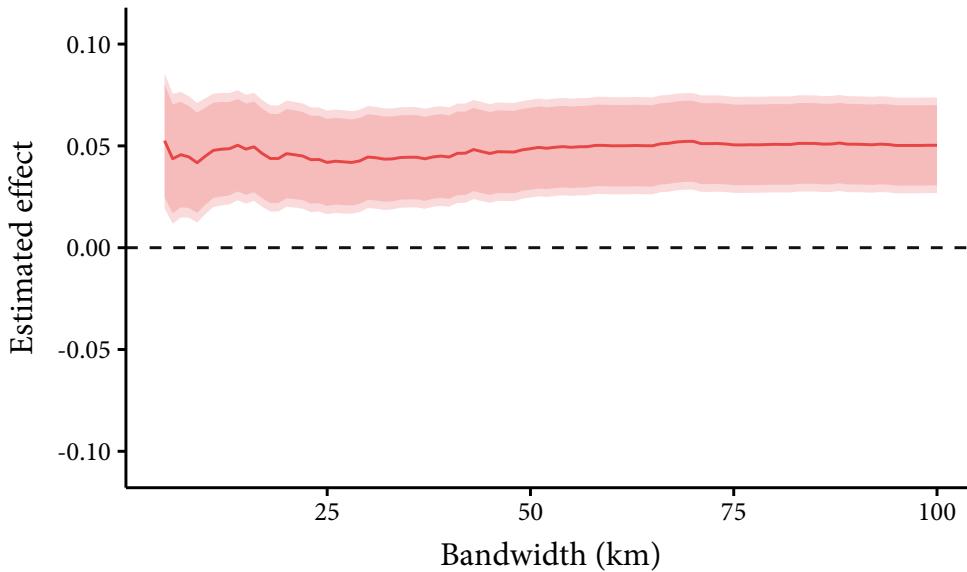


Figure A8: Results of the boundary analysis, showing how the propensity of a respondent to use a mobile phone daily varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

*Dependent variable:* Own mobile phone

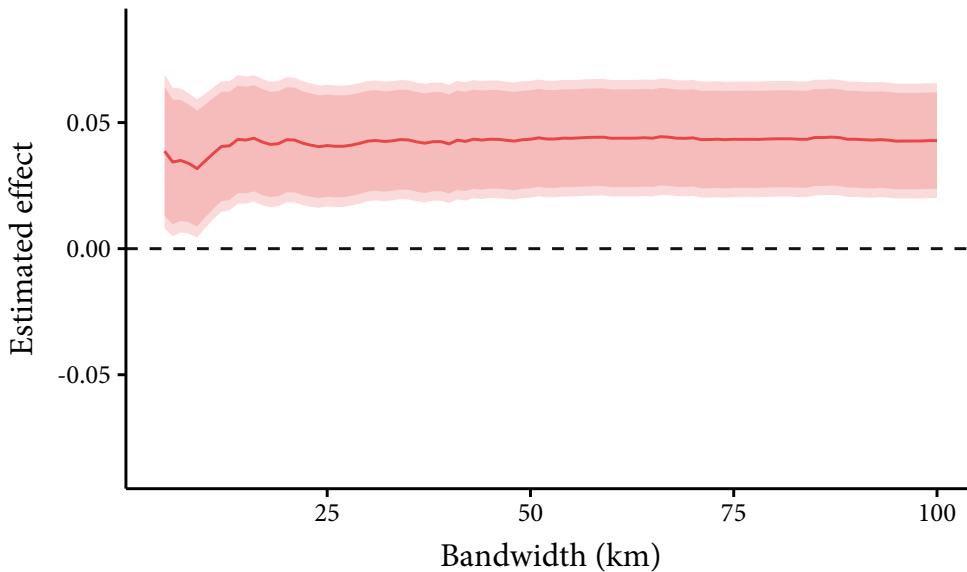


Figure A9: Results of the boundary analysis, showing how the propensity of a respondent to own a mobile phone varies across the 3G coverage boundaries for a variety of bandwidths. 90 and 95 percent confidence intervals clustered by locality are shown.

## A.6 Distribution of election proximity

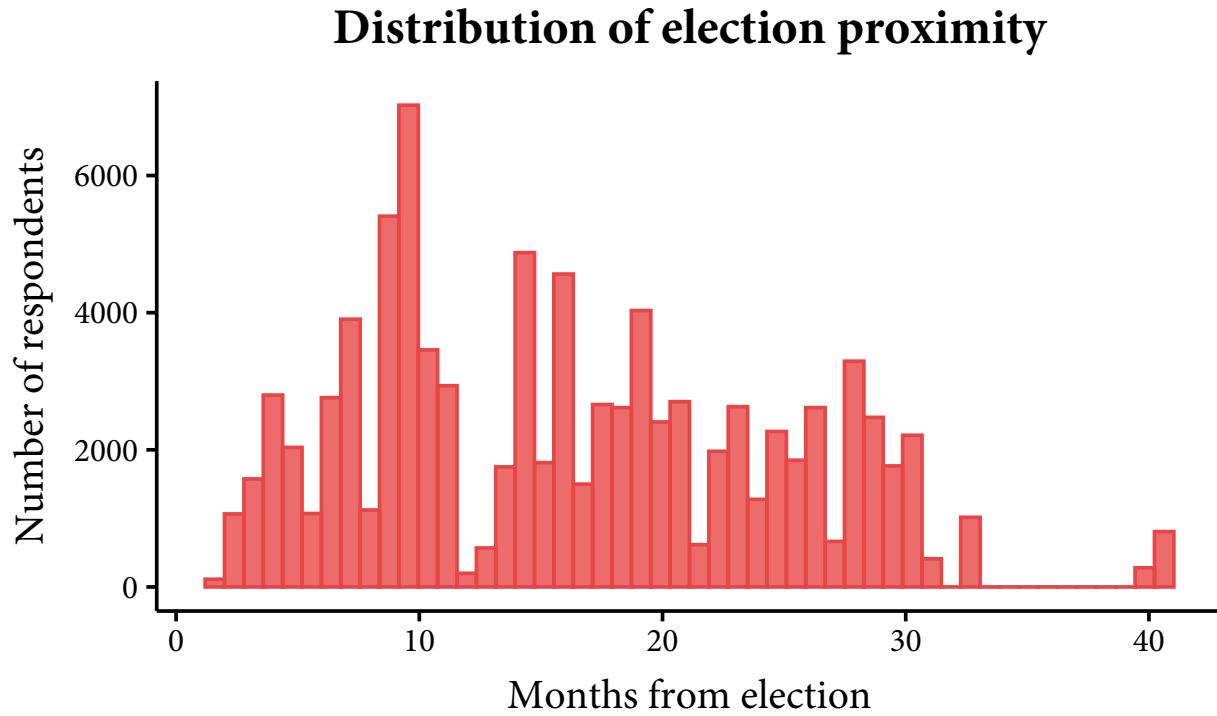


Figure A10: The distribution of months to the nearest election across respondents

## A.7 Additional Robustness Checks

Table A8 shows difference in differences estimates of the effect of mobile internet on national identity for each sequential pair of Afrobarometer survey rounds. We do this to verify that no single round is driving our results. In earlier rounds the sample size is smaller and the estimates noisier because fewer countries are in the GSM Association mobile internet coverage data. Although the point estimates are variable in magnitude, they are all negative and statistically significant. This demonstrates that our results are not driven by a particular time period or survey wave.

Table A9 adds controls for approval of and trust in government officials to table 1 in order to examine whether results for the effect of mobile internet on national identification could be driven by changes in approval of and trust in government officials and institutions. Columns 1 and 2 include controls for respondents' approval of the president and their MP, each measured on a 4-point scale. Columns 3 and 4 include controls for respondents' trust in the president the parliament, which are both also measured on a 4-point scale. The effect of mobile internet remains negative and statistically significant with these controls. These variables are post-treatment, so caution is warranted in interpreting these estimates. However, these results provides evidence that changes in approval and trust in government are unlikely to be driving the effect of mobile internet on national identity.

Table A8: Effect of access to mobile internet on national identification by round

|                          | <i>Dependent variable:</i>                        |                      |                      |                      |                      |                      |
|--------------------------|---|----------------------|----------------------|----------------------|----------------------|----------------------|
|                          | Identify More Nationally Than Ethnically (Binary) |                      |                      |                      |                      |                      |
|                          | Rounds 4 and 5                                    |                      | Rounds 5 and 6       |                      | Rounds 6 and 7       |                      |
|                          | (1)   | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  |
| Mobile internet coverage | -0.106**<br>(0.046)                               | -0.120***<br>(0.045) | -0.098***<br>(0.022) | -0.095***<br>(0.022) | -0.064***<br>(0.015) | -0.051***<br>(0.013) |
| Fixed effects            | Country   | District             | Country              | District             | Country              | District             |
| Demographic controls     | Yes   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Observations             | 4,727   | 4,727                | 16,320               | 16,320               | 44,732               | 44,732               |

*Notes:* Difference in differences estimates of the effect of access to mobile internet on individuals' national identity are shown for each sequential pair of Afrobarometer survey rounds. All models include fixed effects for survey wave and either country or district as well as covariates for gender, age, urban/rural status, and an indicator for whether the individual has completed secondary school. Robust standard errors clustered by locality are shown in parentheses. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01.

Table A9: Effect of access to mobile coverage is not driven by approval of and trust in government

| <i>Dependent variable:</i>                        |                      |                      |                      |                      |
|---|----------------------|----------------------|----------------------|----------------------|
| Identify More Nationally Than Ethnically (Binary) |                      |                      |                      |                      |
|   | (1)                  | (2)                  | (3)                  | (4)                  |
| Mobile internet coverage                          | −0.039***<br>(0.012) | −0.031***<br>(0.011) | −0.065***<br>(0.011) | −0.058***<br>(0.010) |
| Fixed effects                                     |                      |                      |                      |                      |
| Demographic controls                              | Yes                  | Yes                  | Yes                  | Yes                  |
| Government approval controls                      | Yes                  | Yes                  | No                   | No                   |
| Government trust controls                         | No                   | No                   | Yes                  | Yes                  |
| Observations                                      | 45,073               | 45,073               | 51,331               | 51,331               |

*Notes:* Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically. These models include controls for approval of and trust in government officials and institutions. All specifications include fixed effects for survey wave and either country or district. *Government approval controls* are individual-level measures of approval of the president and the respondent's MP, each on a 4-point scale. *Government trust controls* are individual-level measures of trust in the president and parliament, also each on a 4-point scale. Robust standard errors clustered at the locality level are shown in parentheses. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

## A.8 Parallel trends

Table A10: Future mobile internet does not cause reduction in national identity

|                                | <i>Dependent variable:</i>                        |                     |                      |                     |                      |
|--------------------------------|---|---------------------|----------------------|---------------------|----------------------|
|                                | Identify More Nationally Than Ethnically (Binary) |                     |                      |                     |                      |
|                                | (1)   | (2)                 | (3)                  | (4)                 | (5)                  |
| Mobile internet coverage       | -0.101**<br>(0.045)                               | -0.105**<br>(0.046) | -0.118***<br>(0.045) | -0.107**<br>(0.046) | -0.119***<br>(0.045) |
| Mobile internet coverage (t+1) | -0.024<br>(0.029)                                 | -0.025<br>(0.029)   | -0.031<br>(0.029)    | -0.030<br>(0.029)   | -0.037<br>(0.029)    |
| Mobile internet coverage (t+2) | 0.031<br>(0.032)                                  | 0.030<br>(0.032)    | 0.041<br>(0.035)     | 0.036<br>(0.032)    | 0.047<br>(0.035)     |
| Fixed effects                  | Country   | Country             | District             | Country             | District             |
| Demographic controls           | No  | Yes                 | Yes                  | Yes                 | Yes                  |
| Wealth controls                | No  | No                  | No                   | Yes                 | Yes                  |
| Observations                   | 4,791   | 4,727               | 4,727                | 4,645               | 4,645                |

Notes: Difference-in-differences results show the effect of future access to mobile internet on a respondent identifying more nationally than ethnically. Robust standard errors clustered at the locality level are shown in parentheses. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

## A.9 Additional placebo tests

Table A11: Placebo test: effect of access to basic mobile phone service (2G) on national identification

|                       | <i>Dependent variable:</i>                  |                  |                             |                   |  |                  |
|-----------------------|---|------------------|-----------------------------|-------------------|--|------------------|
|                       | Identify more nationally<br>than ethnically |                  | Identify only<br>nationally |                   | National versus ethnic<br>identity (5-point scale) |                  |
|                       | (1)   | (2)              | (3)                         | (4)               | (5)  | (6)              |
| Basic mobile coverage | 0.004<br>(0.014)                            | 0.009<br>(0.013) | 0.0004<br>(0.014)           | -0.011<br>(0.013) | 0.013<br>(0.035)                                   | 0.019<br>(0.033) |
| Fixed effects         | Country                                     | District         | Country                     | District          | Country  | District         |
| Observations          | 38,717                                      | 38,717           | 38,717                      | 38,717            | 38,717   | 38,717           |

Notes: Results of a placebo test using access to basic mobile phone service (2G), which does not provide access to the internet-based platforms through which we argue election-driven polarization occurs. The sample is restricted to the country-waves prior to the introduction of mobile internet in each country. Robust standard errors clustered at the locality level are shown in parentheses. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

Table A12: Effect of access to mobile internet on wealth

|                          | <i>Dependent variable:</i> |                  |                  |
|--------------------------|----------------------------|------------------|------------------|
|                          | Wealth index               |                  |                  |
|                          | (1)                        | (2)              | (3)              |
| Mobile internet coverage | 0.150***<br>(0.026)        | 0.016<br>(0.021) | 0.009<br>(0.020) |
| Fixed effects            | Country                    | Country          | District         |
| Demographic controls     | No                         | Yes              | Yes              |
| Wealth controls          | No                         | No               | No               |
| Observations             | 59,169                     | 58,681           | 58,681           |

*Notes:* Difference in differences results show the effect of mobile internet on a respondent's wealth. Wealth is measured by an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, TV, or motor vehicle. All specifications include fixed effects for survey wave and either country or district. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. Robust standard errors clustered at the locality level are shown in parentheses. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

Table A13: Effect of access to mobile internet on national identity for non-democracies

|                          | <i>Dependent variable:</i>                        |                   |                   |                   |                   |
|--------------------------|---|-------------------|-------------------|-------------------|-------------------|
|                          | Identify More Nationally Than Ethnically (Binary) |                   |                   |                   |                   |
|                          | (1)   | (2)               | (3)               | (4)               | (5)               |
| Mobile internet coverage | -0.006<br>(0.004)                                 | -0.006<br>(0.004) | -0.006<br>(0.004) | -0.006<br>(0.004) | -0.006<br>(0.004) |
| Fixed effects            | Country   | Country           | District          | Country           | District          |
| Demographic controls     | No  | Yes               | Yes               | Yes               | Yes               |
| Wealth controls          | No  | No                | No                | Yes               | Yes               |
| Observations             | 2,047   | 2,044             | 2,044             | 2,038             | 2,038             |

*Notes:* Difference in differences results show the effect of mobile internet on a respondent identifying more nationally than ethnically for the least democratic countries surveyed by Afrobarometer: Swaziland and Sudan. All specifications include fixed effects for survey wave and either country or district. *Demographic controls* include individual-level measures of gender, age, completion of secondary education, and whether their residence is classified as urban or rural by Afrobarometer. *Wealth controls* include an index of asset ownership as reported in the Afrobarometer surveys. Survey items probed whether a respondent owned a radio, TV, or motor vehicle. We include an index created from the dichotomous measure of each asset ownership. Robust standard errors clustered at the locality level are shown in parentheses.  
\*p<0.1; \*\*p<0.05; \*\*\*p<0.01.